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Public Works

IN THIS ISSUE:

How War Changed a Sewage Plant

An Emergency Pumping Station

Stabilized Sand and Gravel Bases

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CHEM-O-FEEDER

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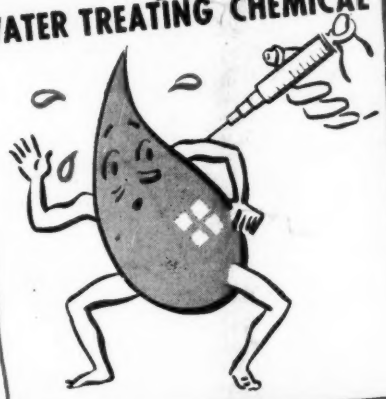

to make
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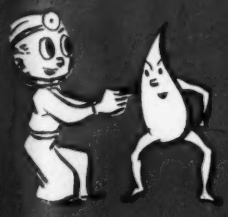

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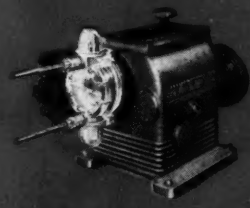

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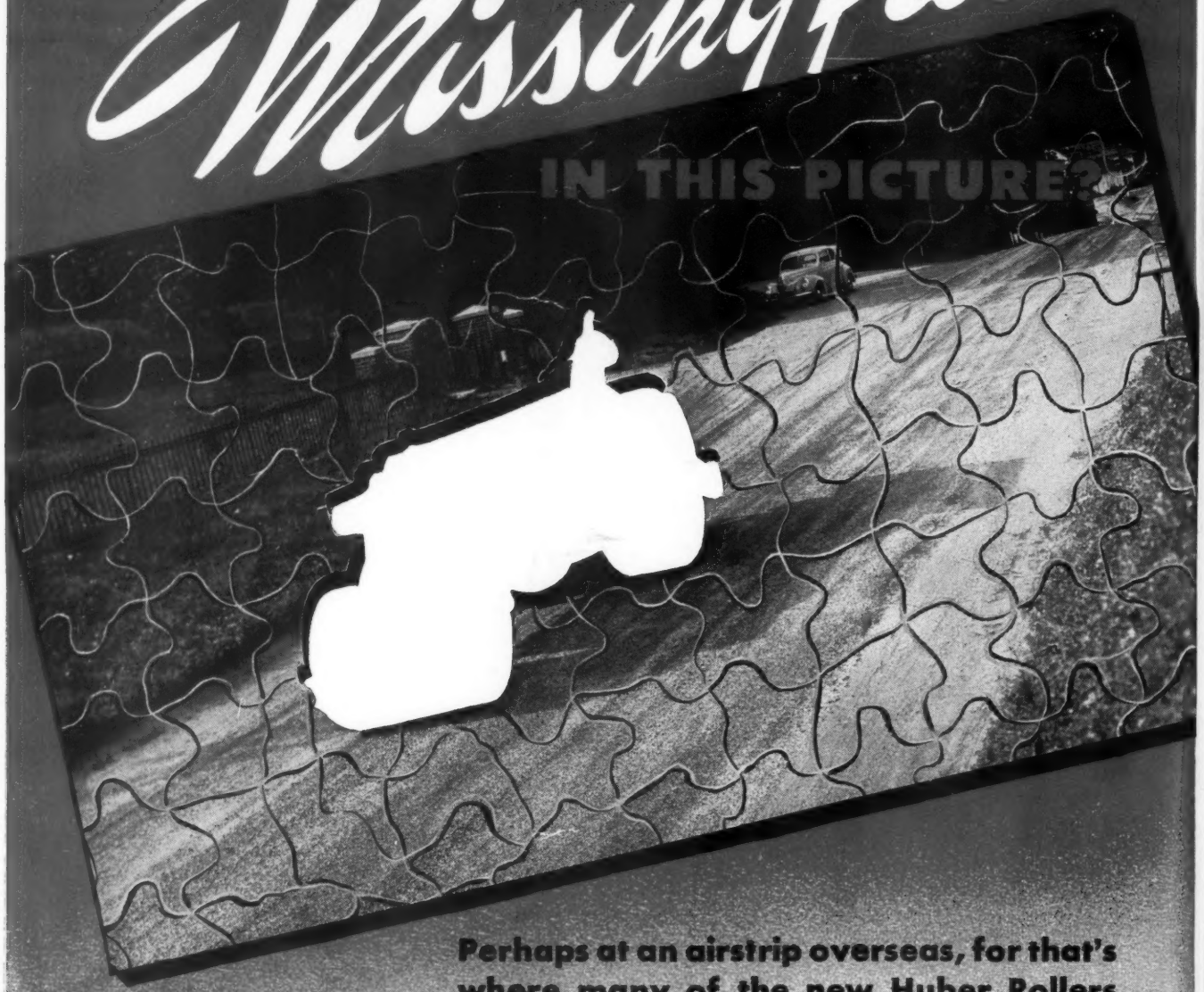

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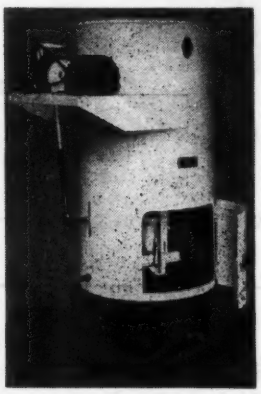

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Vol. 76 No. 1

A. PRESCOTT FOLWELL, Editor

JANUARY CONTENTS

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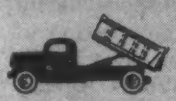
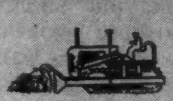


HOISTS AND BODIES

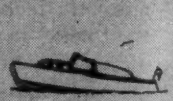
WINCHES AND CRANES

TANKS



ROAD MACHINERY

HEATING EQUIPMENT



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PUBLIC WORKS Magazine . . . January, 1945

VOL. 76. NO. 1

Central mixing plant for making stabilized mixture.

Experiments With Stabilized Sand and Gravel Bases

Method of constructing 13.4 miles of various thicknesses, and results during six years of use, two of them without cover and four with a bituminous wearing surface.

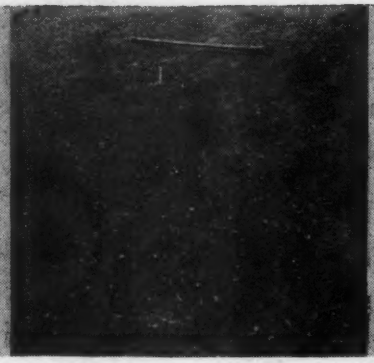
THESE test sections were laid in the Red River Valley of Minnesota, on 13.4 miles of U. S. Highway 75, by the Minnesota Dept. of Highways and the Public Roads Administration. A traffic count made in 1941 showed that the road carried 394 vehicles per day (24-hour average), of which 14% were commercial vehicles such as light, medium and heavy trucks and buses.

Truck resting on platform scale being loaded with stabilized mixture.

The soils under this highway are heavy plastic clays or silty clays, commonly known as gumbo. They had been surfaced with loose sand and gravel, but these gradually penetrated into the subgrade to great depths and produced no apparent increase in stability. Later the blotter type of bituminous surface was used but, while an improvement, was not entirely satisfactory. Stabilized bases with thin bituminous wearing courses having given excellent performance elsewhere, it was decided to test them here.

Desiring to learn what thickness it would be best to use, 16 test sections were laid, having thicknesses of 1, 2, 3, 4, 6 and 8 inches. Four of them were placed directly on the existing bituminous surface; for the other 12, this was removed before placing the stabilized base material. Two sections were made with binder soil mixed with sand, the other 14 mixed with a mixture of sand and gravel. Variations in plasticity index were obtained by varying the proportion of binder soil. The binder soils used contained from 1% to 3% coarse sand, 3% to 13% fine sand, 32% to

Typical section completed 3 weeks before a heavy rain.



Showing surface raveling.

Completed 2 days before a heavy rain.

48% silt, and 44% to 64% clay. The plasticity index of these varied from 25% to 38%. All the gravel used passed the ¾ sieve, an average of 86% passed the ⅜ inch, 70% the No. 4 sieve, 53% the No. 10, 20% the No. 40 and 2% the No. 100. All the sand passed the No. 4 sieve, 95% the No. 10, 38% the No. 40 and 2% the No. 200.

Construction Methods

After the subgrade had been bladed to the desired cross-section, the stabilized mixture was deposited in the center of the road by trucks carrying 4.2 tons each (by actual weight), in piles spaced 22 ft. apart for the 1 inch layer, 11 ft. for the 2-inch, etc. These were spread and shaped by a motor grader and compacted by a multiwheel, pneumatic-tire 6-ton roller until a uniformly dense surface was obtained.

In mixing, 0.45% calcium chloride had been added, and 0.25 lb. per sq. yd. additional was applied to the surface immediately after shaping and prior to the final rolling, and another 0.25 lb. was spread over the central 24 ft. following a rain or after sprinkling with 2,000 to 3,000 gal. of water per mile.

Preparing the Stabilized Mixture

The different materials used in the stabilized mixtures were stock piled in a central mixing plant where they were combined. The plant consisted of a portable single pugmill continuous mixer equipped with a clay feeder; clay shredder; spray pipes for adding water; hoppers with adjustable gates for feeding the proper amounts of mineral salts, sand, and gravel; and belt conveyors for introducing the different materials into the mixer and discharging the mixture into a storage bin. Power was furnished by a 60-horsepower tractor. The output of the plant varied from 65 to 95 tons of mixed material per hour.

In the operation of the plant a controlled amount of clay was fed by screw conveyors to a belt conveyor which introduced the clay into the clay shredder at the top of the plant where it was pulverized before entering the pugmill. Figure 2 shows the trap through which the binder soil was loaded into the clay feeder and the belt conveyor for delivering the soil to the shredder.

The same belt conveyor which elevated the binder soil was also used to deliver sacks of calcium chloride to the salt hopper at the top of the plant, from which it was fed at a controlled rate through an adjustable gate into the pugmill.

Simultaneously with the introduction of the binder soil, calcium chloride, and a regulated amount of water, the sand and gravel were introduced on another belt conveyor. The mixed material was discharged from the pugmill onto a third belt conveyor which carried the mixture to a storage bin located directly over a weighing platform.

Proportioning of the various materials was controlled by regulating the rate of feed to the mixer. First the speeds of the conveyor belts were determined while the plant was running at its normal operating speed. Then the plant was stopped and the weight of material on a 10-foot section of each belt was measured. From these two determinations the amount of each material delivered to the pugmill in a given time was calculated. Gate openings on the material hoppers were then adjusted until the desired proportions were obtained.

A final check on the proportioning was made by taking samples of the mixture discharged from the pugmill and determining their gradations, physical constants, and moisture contents.

The stabilized mixture was loaded from the storage bin into trucks resting on platform scales and hauled out and deposited in the center of the road.

Tests on samples taken from the different sections show that the stabilized mixtures were well graded and that gradation of the mixtures was very uniform in all sections.

Potholes developed in early spring.

The uniformity of the mixtures indicates the efficiency of the methods of mixing and control adopted on this project. Study of the performance of the different sections is not complicated by lack of uniformity in the mix. The liquid limit and plasticity index of the mixtures were not influenced by the origin of the binder soil used nor by its chemical composition, except insofar as these affected the plasticity of the binder soil.

Within two weeks of completion of the section 1″ thick, the surface became loose and raveled, and it was replaced with a 4″ course, it being evident that less than this would not be satisfactory.

The weather was unusually hot and dry during the ten weeks of construction and the surface became dry and loose, and the rain that followed soaked in and softened the surface, causing rutting; but all surface irregularities were removed with motor graders, and thereafter all the sections were maintained in good condition by light blading.

Density measurements taken in the different sections after 5 days or less of traffic showed densities of the upper 2 or 3 inches ranging from 128 to 136 lb. per cu. ft.; after 15 to 31 days of traffic this had increased to 134-141; and after 35 to 80 days, to 136-142. The densities of the bottom layer were each time 4 to 5 lb. less. In general, the sand sections had lower average densities than the gravel sections.

During two years of use as a wearing surface, loose gravel formed on the surface of all sections; and other surface defects formed, such as corrugations, raveling, pitting, scaling, potholes, shrinkage cracks, and wearing out of the entire thickness of the stabilized surface.

Raveling denotes a progressive breaking up of the surface resulting from the displacement of loosened material. It differs from the ordinary development of float on the surface in that loosening and displacement of measureable thicknesses occur in localized areas. In some places, raveling progressed to the extent that the entire surface was worn off. Scaling refers to the condition where the surface peels off in layers.

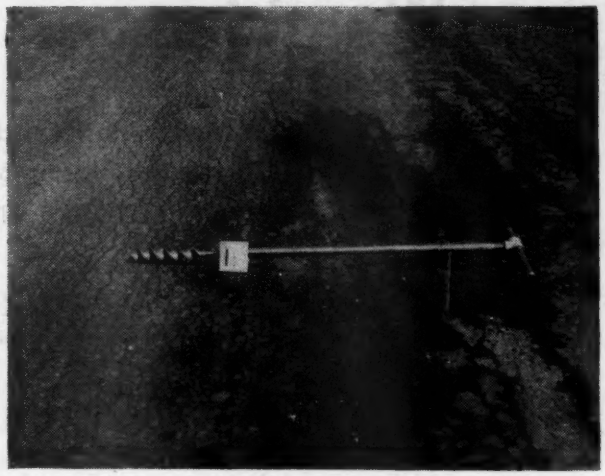
Shrinkage cracks occurred in the sections having a total thickness of 3 inches or less. No detrimental were observed as a result of this condition.

Pitting indicates the presence of abrupt surface cavities so small in size that, as a rule, they do not interfere with the riding qualities of the road. Potholes refer to cavities deep enough and large enough to cause excessive surface roughness.

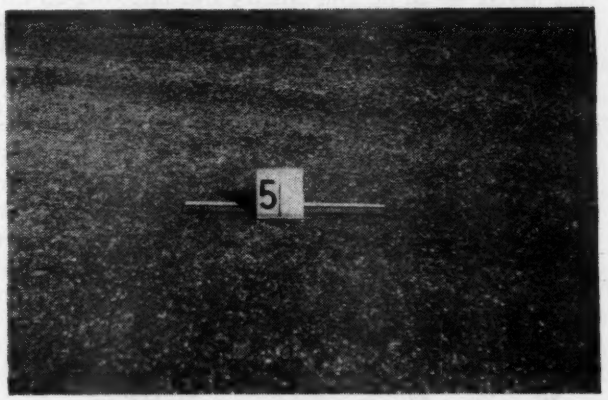
Practically all of these defects occurred during dry summer weather. Areas, where the entire thickness of stabilized surfacing was displaced, were repaired by patching with a stabilized mixture of materials similar to those used in the original construction. The other defects were corrected with surface applications of calcium chloride and blading after rains. Following the blading of the moistened surface, no difference in condition was visible on the various sections.

The mixture deposited in a windrow in the center of the road.

Appreciable deformation and displacement causing the surface to crack badly and peel off.



Surface breakage.



Alligator type cracking with slight deformation.

The surface of the sand-clay sections was highly polished, with numerous small round bumps, probably due to clay brought on from the shoulders.

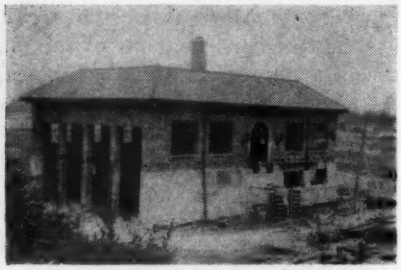
During winters the surface froze solid and suffered very little wear. But with spring thaws, potholes developed over the entire project, but were shallow, the stabilized material underneath remaining firm and compact and no ruts appearing. Blading filled the potholes and produced a smooth surface.

(Continued on page 32)

Before raising.

On blocks during raising.

Raising the pumping station.



New walls poured, before ground was raised by filling. Pumping equipment is in basement.

War Changes a Sewage Plant

Construction of Mahoning river dam flooded the fifteen-year-old plant of Alliance, Ohio, necessitating several changes, including raising the pumping station and the entire plant site.

By **DONALD D. HEFFELFINGER**

Superintendent of Sewage Treatment, Alliance, Ohio*

CONGRESS on December 3, 1941, approved funds for the construction of a dam on the Mahoning river between Alliance and Youngstown, Ohio, as a national defense measure. This project, which was to cost nearly seven million dollars and impound 23 billion gallons of water ,was for the dual purpose of flood control and of providing industrial water (through stream flow regulation) to the highly industrialized Mahoning valley cities, where one-third of the nation's steel is produced.

After a thorough survey by the U. S. Army Engineers, the dam was located at Berlin and the crest of the spillway was designed at an elevation of 1,032 ft. above sea level. This elevation gave a depth of water at the dam of 82 feet at full reservoir, and inundated over 3,500 acres of the upper Mahoning valley, the backwater reaching into the city limits of Alliance some ten miles upstream.

Alliance, a city of 25,000 persons, operates a sewage treatment plant some two miles north of the city, the effluent from this plant emptying into the Mahoning river. (Alliance has been a pioneer in sewage treatment, the present plant being the city's fourth, and was constructed in 1929 at a cost of $800,000.)

When it was found that the proposed Berlin reservoir would completely inundate the sewage treatment plant, negotiations were immediately started with the U. S. Army Engineers for protection for the plant. The city engaged the services of Blum, Weldin & Co. and the Chester Engineers, of Pittsburgh, as consultants, and they as well as the Army Engineers prepared plans for protection.

After numerous conferences, plans and counter plans, claims for damage, etc., the city finally decided to proceed with the plan of their own consulting engineers, and the Federal Government made a cash settlement on May 18, 1942, of $366,500. This figure included the amount paid for a flowage easement over 243 acres of land owned by the city, including 17 acres of plant site, as well as the damage to the plant. The amount of the latter was based upon the plans designed by the U. S. Army Engineers for the protection of the plant.

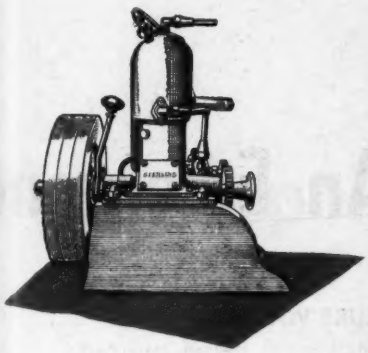
Meanwhile the construction of the Berlin dam had been started in January of 1942, with one year allotted for completion, so that very little time was available for the preparation of detailed plans and specifications for changes in the sewage plant, awarding of contracts, and getting the work under way.

The sewage from the city flows to the treatment plant by gravity, with the exception of one small district. At the plant the sewage passes through bar screens, is settled in Imhoff tanks and then pumped to dosing tanks, from where it is sprayed onto 1.2 acres of trickling filters by means of laterals and fixed nozzles. After filtering through 10-foot deep trickling

(Continued on page 42)

*At present on leave of absence to serve as Director of Public Safety and Service.

Trickling filters. 5 ft. of stone removed from filter at left.



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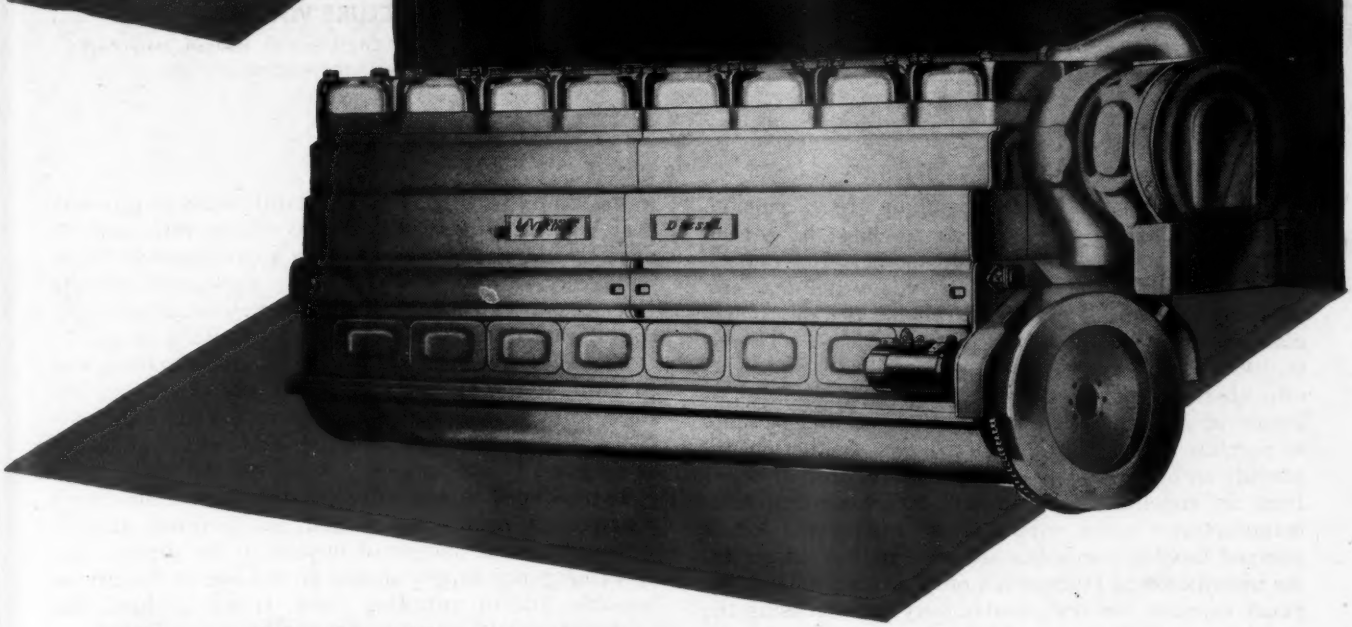

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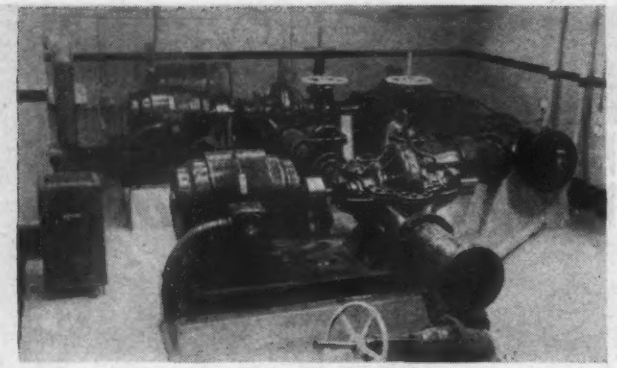


View of pumping station interior.

An Emergency Wa

By J. McCLURE WARDLE
Supt. of Public Works and City Engineer, Hudson, New York

PUMPING stations for water supply are so common, it seems that all types of service must have been described in print at one time or another. However, it has never come to the attention of this writer that any pumping system has exactly paralleled the emergency plant recently completed in Hudson, N. Y. This is probably because each pumping application has its own characteristics peculiar to that particular set of conditions. Of course, these conditions needn't be quite so peculiar as found in this city, but this situation did provide an opportunity to wring the last drop of water from an impeller on paper, and then hope that some manufacturer could supply such equipment. While pumped auxiliary supplies are more or less numerous, the installation in Hudson not only serves in this emergency capacity but does double duty by increasing the normal supply more than 50% when needed.

Perhaps it would be well to begin by stating the nature of the water supply problem confronting the city. It is probable that all water systems, except perhaps some most fortunate ones, eventually reach a point where the established supply is sufficient for normal consumption, but leaves no factor of safety when the demand increases slightly. This was the case here, with the following enumerated troubles constituting the problem to be solved.

1. Dry-weather shortages due to depleted reserve storage caused by insufficient yield.
2. Limited capacity of supply main leading to the city from storage reservoir and source.
3. Danger of supply to the city being cut off due to mishap to the outlying 13 miles of supply main.

The above ills were in no way fancied, as witness the fact that the city, after many close calls, did actually experience a complete failure of the supply due to cause No. 1, and was kept supplied only by the use of fire pumpers, as described in PUBLIC WORKS Magazine for August, 1942.

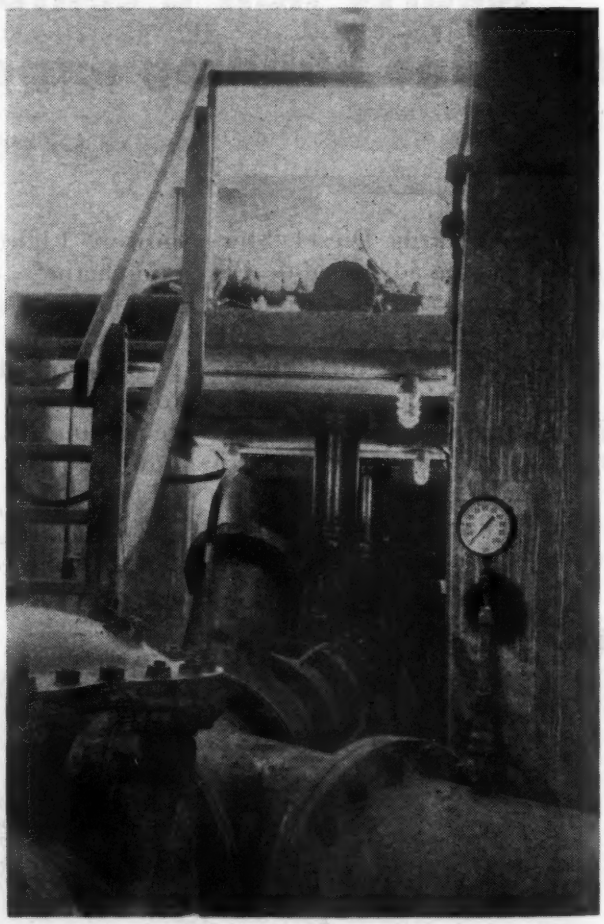
Trouble No. 2 proved to be real many times both winter and summer when the city demand, normally 1.8 mgd, increased above the 2.0 mgd capacity of the gravity supply main to the city, due either to breaks in the aged distribution system or to excessive consumer use.

Number 3 ranged all the way from a farmer dynamiting drainage ditches directly above the main (successfully blowing a hole in it and reversing his desires) to extensive landslides reaching within 5 feet of the pipe, and to hurricane washouts at ravine crossings, leaving the line suspended from bank to bank.

To cure all these ailments with one fell swoop of design seemed well nigh impossible, but practically this was accomplished. The basic hydraulic study progressed over a period of several years, as efforts were made to open the municipal purse for an appropriation. These endeavors were successful after the fire engine episode referred to above, and the problem was attacked by consultants retained to refine and detail the work.

The approach was normal in that consideration was given to additional or larger dams and pipe lines, but these proved very expensive, and in the final analysis did not give the many advantages and degree of safety to be gained by pumping.

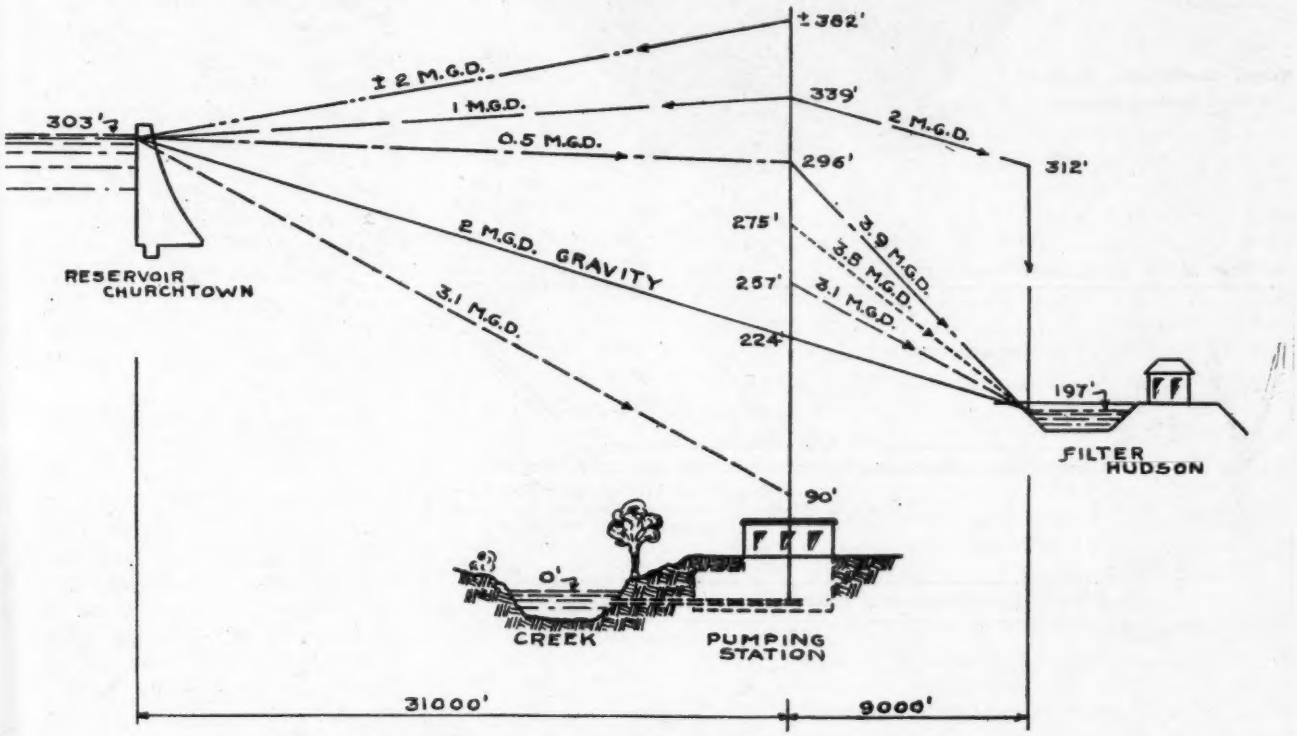
It developed that to solve the dry-weather shortages an auxiliary supply was needed, and to insure against the ever present danger of mishap to the supply line, this emergency supply should be as close to the city as possible, and of unfailing yield. It was decided that provision should be made for not less than 3 mgd.



Entrance to suction tunnel.

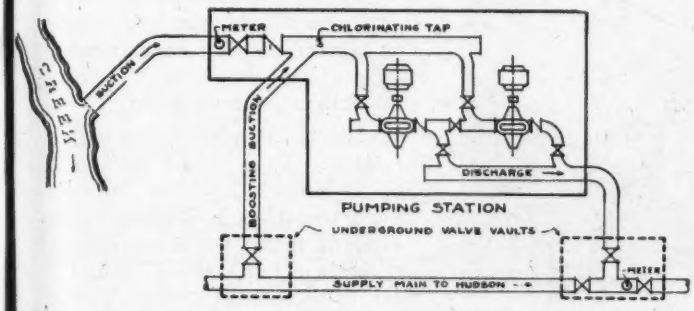
nd Water Supply Pumping Station

How Hudson, N. Y., solved the problem presented by insufficient yield of its watershed, limited capacity of its only supply main, and danger of accident to it.



Sketch showing various hydraulic gradients and working heads.

Claverack Creek, under which the supply main crossed at a point less than 2 miles from town, had been gauged for several years and showed a low flow of 4.5 mgd during one of the driest of summers—and then for only a very short period. Pursuing this possibility, it was realized that the flow in this creek could be bolstered if necessary by drawing from a large lake located within its watershed area. Further consideration brought the thought that an additional safeguard would be gained if the pumps selected to deliver water from this creek to the city via the regular supply main, could also deliver some water back through the other end of the line, 6 miles to the large storage at Churchtown when the entire pumping capacity was not needed toward the city. In this way it would be possible to anticipate a dry-weather shortage when the storage showed signs of depletion; making it practicable to pump both to the city and back to storage long before the creek flow was at its lowest; and who wouldn't like to have their storage refilled about August 1st in a dry year? A very fancy idea indeed, if it could be made to work. Computations showed the head required to put 2 mgd back to storage would develop about 165 lbs. per sq. in. pressure at the lowest point of the line, which was known to have withstood surges of 175 lbs. per sq. in. More likely the available delivery would be much below 2 mgd in this direction, so there seemed to be encouragement for the idea.



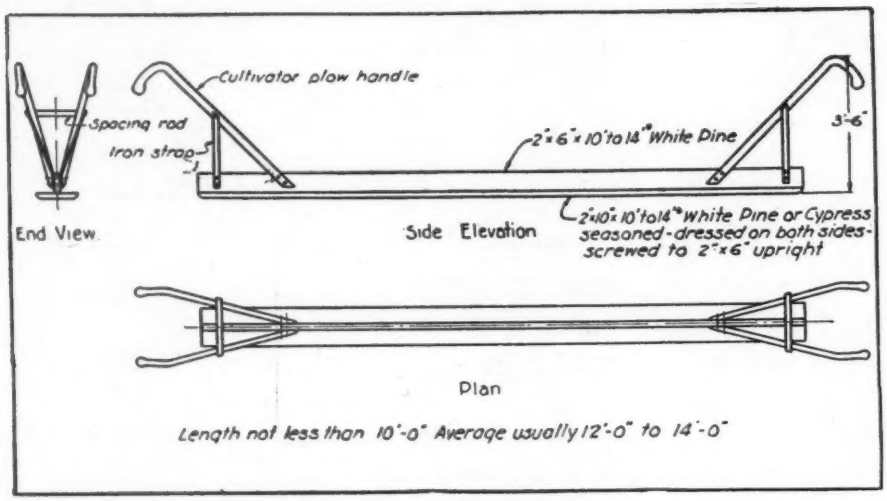
Schematic arrangement of piping, valves, etc., at the pumping station.

This appeared to solve the auxiliary supply problem, but it seemed poor economics to pump an inferior water at considerable expense from the creek, at times when there was plenty in higher storage which couldn't go to town quite fast enough. Obviously boosting was the answer, but there was a limit to the number of dif-

(Continued on page 48)

Equipmen or

Heltzel Combination Batcher with Collecting Hopper.



Construction of a longitudinal float.

Haiss 5 yd. a minute Model 80-W Loader putting up truck loads of 1½ inch crushed stone.

FOR mixing, placing, and finishing concrete pavements on roads or streets according to the best modern practice, it is necessary to use a mixer; (a mechanical spreader is optional); a finishing machine; a longitudinal float, either mechanical or hand; bridges; a utility truck; and small tools such as finishing belts, floats, edgers, straight edges, shovels, and vibrating equipment for compacting the concrete along forms and joints.

Mixers. For mixing concrete for pavements, 27-E or 34-E mixers are generally used. Smaller mixers are used for placing curb and gutter and other small jobs. Standards for concrete mixers have been adopted by the Associated General Contractors of America. According to these, the size is designated by a number which equals its rated capacity in cubic feet of mixed concrete per batch, with a guaranteed capacity 10% greater than the rated. They are divided into two general classes—Construction Mixers and Paving Mixers; the former designated by the letter S following the capacity number, the latter by the letter E.

There are two types of construction mixers, single-compartment one-opening drum and single-compartment two-opening. There are two types of paving mixers, single-compartment two-opening drum and two-compartment three-opening.

Construction mixers are made of sizes 3½, 5, 7, 10, 14, 28, 56, 84 and 112. Both single-compartment and double-compartment drum paving mixers are made of two sizes, 27-E and 34-E. The actual interior drum volume of a standard 27-E

or Placing Concrete Pavements

What is necessary or desirable for mixing, placing and finishing concrete pavements on roads or streets. Mixers, bins, trucks, spreaders, finishers, floats and other hand tools. Ready mixed concrete.

paver is not more than 110.16 cu. ft. nor less than 101.79 cu. ft.; and that of a 34-E lies between 136.34 and 126.14 cu. ft.

Actual mixing should be continued for not less than 45 seconds nor more than a minute. A 27-E paver can deliver 48 batches per hour working steadily at the maximum. Normally the output will be lower, as no job runs at 100% efficiency all the time, and the probable expectancy will be about 75% of the maximum or 36 batches per hour. However, the other equipment should be such that it can furnish and place the maximum in order to be on the safe side and eliminate delay at the mixer, idleness of which involves a greater loss per minute than that of all the other equipment.

A 34-E single-drum paver will deliver the same number of batches as a 27-E but they will be correspondingly larger. A 34-E dual-drum mixer is capable of delivering some 72 batches per hour. All three mixers can be operated with a 10 per cent overcharge. At the maximum capacity, the three mixers could deliver the following amounts of concrete:

Mixer Type	Batch Size (Cu. ft.)	No. Per Hour	Cubic Feet Per Hr.	Square Yards of 8" Pavement Per Hr.	Per 8 Hr. Day
27-E	29.7	48	1426	238	1904
34-E	37.4	48	1795	299	2392
34-E (dual drum)...	37.4	72	2693	449	3592

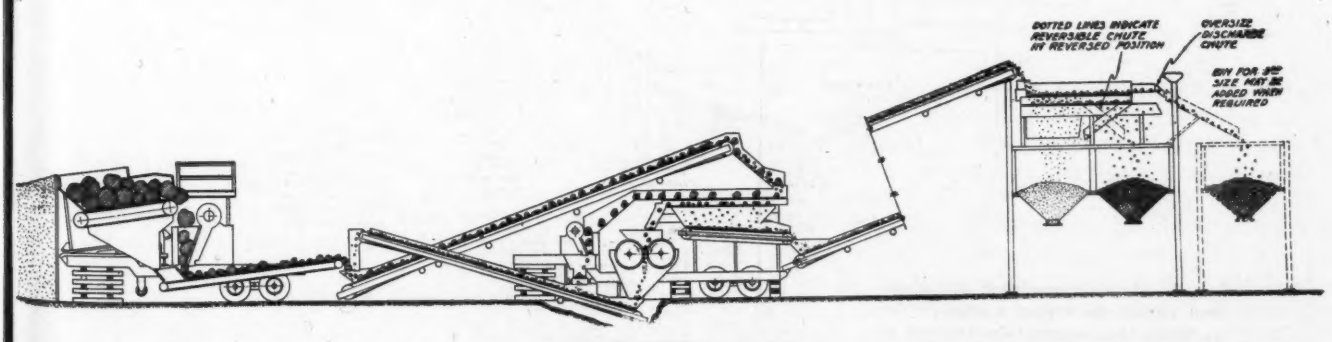
The amount of aggregate required is dependent upon the proportions of the mix specified, which vary considerably. A typical mix would require approximately ¾ ton of sand, 1¼ tons of gravel and 6 sacks of cement per batch for a 27-E paver. In an hour, a maximum of 36 tons of sand, 60 tons of gravel and 72 barrels of cement would be required.

Aggregate Bins. Enough bin capacity, storage space and crane equipment must be provided to deliver that amount of material. There are several manufacturers of bin equipment who have engineering staffs to advise on equipment requirements. Conditions and specifications vary so widely that no general recommendations can be made.

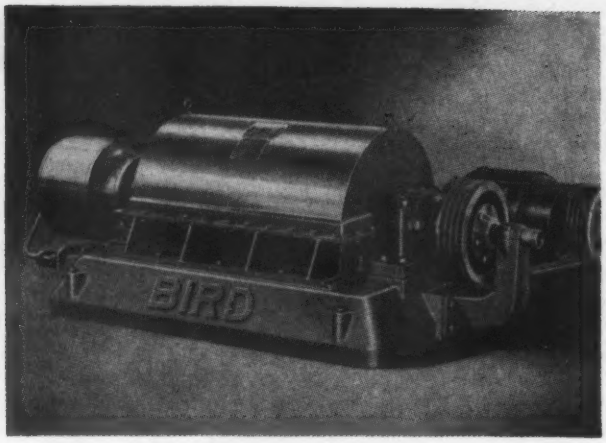
Specifications for practically all paving projects require that aggregates be measured by weight. As a result, all the bins manufactured for paving projects include weighing scales and batchers. These can be set to the amounts required by the engineer and will indicate when the correct weights of fine and coarse aggregates for each batch have been measured into the hoppers. Hoppers hung on the levers of a beam or dial scale are set beneath the aggregate bins and material is run into them until the proper weight is secured. On the beam scale a telltale dial, registering the last 100 or so pounds of the batch, is used to warn the operator when the correct weight is approaching. If proportions are stated by volume, the weight per cubic foot of each aggregate is determined in converting proportions to batch weights. The moisture in the aggregate must be added to the dry weight to get the weight actually set off on the scale. Moisture in the sand is readily determined by weighing a sample in the damp condition in which it is used, drying it and reweighing. For sand in average stockpile condition, the error will be small if moisture content is assumed to be 4 per cent.

Bulk cement is always measured by weight, as volume measurement is inaccurate. Some method of transporting it into the weighing hopper is desirable, as it does not flow well, easily clogging a chute. There are two common methods of unloading and batching bulk cement. With one, the cement is picked up in the car with a loader pushed about by 1 or 2 men, and is pumped through hose and pipe to an elevated bin equipped with weighing hoppers. With the other, two-

(Continued on page 34)



Flow sheet of Cedarapids special rock plant which is designed for maximum efficiency in handling big rock direct from the quarry.



A Bird centrifge assembled for use.

Recalcining Sludge

THE least satisfactorily solved problem in connection with water softening by the lime process is disposing of the resulting sludge. In a plant using 2 lb. of lime per 1,000 gal. of water treated, the sludge would contain about 5,000 lb. of dried solids per million gallons treated; and if the sludge is concentrated to 15% solids there would be 3,600 gal. of it to dispose of. If disposed of by lagooning to a depth of 2 ft. there would be required 2 acres per mgd per year.

Some plants located on large rivers can discharge the sludge into the river; but there are presumably few cases where it will be possible to continue this practice indefinitely. If lagooning is adopted, there is a time limit set by the acreage available for use as lagoons.

Drying Sludge

Sludge from lime softening consists principally of calcium carbonate, with generally a greater or less amount of magnesium hydroxide, iron and other impurities. If this be dried it can, in many cases, be sold for agricultural purposes, possibly yielding sufficient return to cover the cost of drying or even yield a profit.

Some sludges concentrate in the sedimentation tanks to 27-33% solids, in others it is difficult to obtain 10%. This means that 67 to 90% of the sludge is water to be removed.

Complete drying requires the use of heat, which is expensive. Part of the expense of heat drying is customarily avoided by preliminary mechanical dewatering, by either vacuum filters or centrifuges. Use of vacuum filters was studied by the Metropolitan Water District of Southern California and adopted by it in connection with softening Colorado river water. (See Journal American Water Works Ass'n for 1939, page 640. These tests indicated that the moisture content could thus be reduced to 50% and filter cake containing 400 lb. of dry solids be obtained per day per square foot of filter area.

Centrifuging using a Bird continuous centrifuge was tested at Findlay, O., water plant in 1939, at Kankakee, Ill., in 1941, and at Marshalltown, Ia., in 1942, and was adopted for use there, and more recently at the plant of the Wright Aeronautical Corp., which softens 20 mgd of water. At Findlay an 18" centrifuge delivered 500 lb. per hr. of dry solids with 61% solids in the cake, recovering 75% of the feed solids. By carbonating the sludge to remove some of the magnesium, the capacity was increased to 2,300 lb. per hr. of dry solids with a solids content of 67% and a recovery of 79%; while recovery as high as 95% was obtained when the feed rate was reduced to yield 765 lb. per hr. of dry solids. At Kankakee, 90.5% recovery and 65.6% solids were obtained when feeding at a rate to yield 2,200 lb. per hr.

For final drying, several types of dryer have been used—including horizontal rotary, multiple hearth and

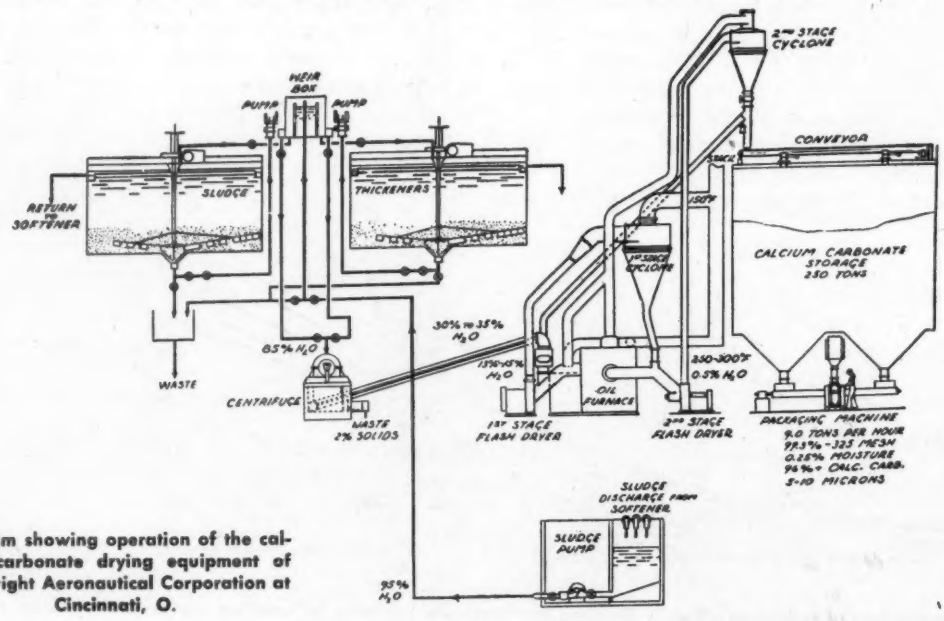
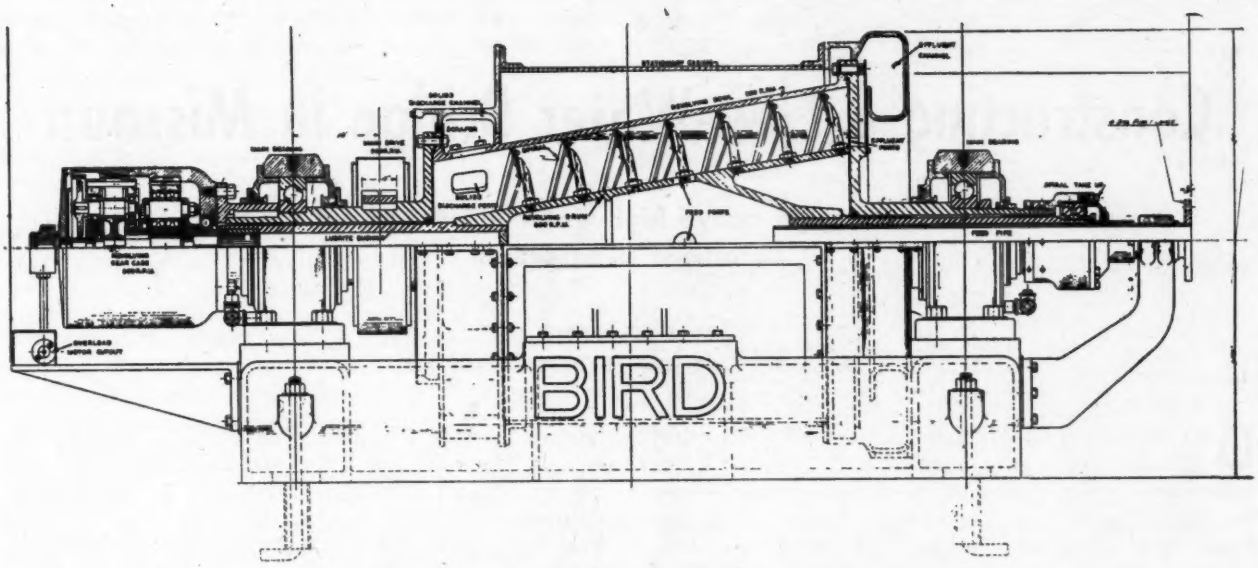


Diagram showing operation of the calcium carbonate drying equipment of the Wright Aeronautical Corporation at Cincinnati, O.

dgom Water Softening

Methods and devices employed, and advantages of recalcining. Developments, recent and in the making, promise to make recalcining financially as well as technically successful for even small plants.



Bird continuous centrifugal, solid bowl type; 36" x 50" sectional assembly.

flash dryers. The C-E Raymond system, the latest development of flash drying for this purpose, contains, as the chief units, a furnace, flash dryer, wet and dry sludge mixer, odor and moisture separator, heat exchanger and fly ash remover. As used for these water softening sludges, the sludge cake is first conditioned by adding a predetermined amount of previously dried sludge, thus reducing the moisture content of the mixture to the point where the material becomes quite fluffy, when it is discharged to the wet stage, where it is pre-dried. The gases from this stage (and this stage only) are discharged to the atmosphere, their temperature being only 150° to 160°. This stage acts as a wet dust collector and no other dust collector is required. The predried material is discharged to the finishing stage, where it is dried to a dry, fine powder of approximately 0.5% moisture, 80 to 99% of which will pass through a 325-mesh screen.

Such a dryer was put into use at the Marshalltown, Iowa, plant in 1941. Its operation was very satisfactory, but they found little sale for the carbonate, and experimented with calcining it and using the resulting calcium oxide instead of purchased lime in the softening plant.

Calcining Sludge

This calcining and re-use of sludge in softening plants was not a new idea, but its application in practice has been found to be complicated by the presence in practically all hard waters of magnesium, which is precipitated as magnesium hydroxide. Since it does not go out in solution and each re-use of the calcined sludge adds to its magnesium content, it soon accumulates to the point where it seriously interferes with the treatment process. Two methods have been devised for removing the magnesium before the final precipitate is formed—the Lykken-Estabrook process and the Hoover process. In the former, recovered sludge is mixed with enough water to dissolve all the lime, and the sludge from this, which contains all the Mg that was in the recovered sludge, is wasted and clear lime water results. In the Hoover process, just sufficient lime is added to precipitate the CaO and not the Mg, and the sludge from this is that recovered.

Most of the magnesium hydroxide can be removed by carbonation in several ways. Recently it has been demonstrated that the continuous centrifuge rejects a considerable portion of the magnesium, which passes off with the centrate.

While calcination of limestone has been practiced for years, calcination of softening-process sludge differs from it in several ways. The flash-dried sludge is of so fine a texture that the carbon dioxide formed by heating cannot escape from it unless it is stirred vigor-

(Continued on page 30)

View of low-water bridge completed.

Constructing a Low-Water Bridge in Missouri

Where cost of a bridge above high-water level was not warranted. Details of construction.

By E. G. BENZ
County Highway Engineer, Gasconade County, Mo.

DRY Fork Creek, Missouri, is crossed by a rural delivery route two miles east of Bern, and one mile above its junction with the Bourbois river. There was no bridge here, and the 100-ft. channel was sometimes made impassable for days at a time by the backing up of the river, making it a hazard to the mail carrier.

The construction of a bridge here was out of the question on account of the shortage of labor and material, and the county court decided in 1944, after a preliminary survey by the writer, to construct a low-water bridge for the present. This bridge, which was begun August 22 and completed September 21, is 18 ft. wide and 150 ft. long, including two 25-ft. approaches. The work was performed by such local labor as was available, under the supervision of the county highway engineer.

The bridge consists of a reinforced concrete slab 10″ thick, 18 ft. wide and 100 ft. long, ten 10 ft. spans resting on nine bents and the two walls which, with side walls, enclosed the approaches. This gave ten underpasses or channel openings to permit passage of the water. The finished floor is level longitudinally, 36″ above low water level, and 2″ higher on the down-stream side than on the up-stream. Expansion joints were constructed at 20 ft. intervals. Longitudinal reinforcement consisted of ¾″ round deformed bars 20 ft. long, and transverse reinforcement of ½″ bars.

The bridge is supported on white oak piles, spaced 3 ft. on centers, six to a bent and to each approach wall, driven down to solid bed rock by use of a 600 lb. hammer and a home-made pile driver. They were sawed off below low-water level and each bent capped with a concrete base 30″ wide and 20″ high; on which was constructed a pier 16″ wide, leaving a 7″ shelf on each side. The falsework for the floor slab was supported on these 7″ shelves, on which 2″ plank were held in place by dowel pins and supported 2 x 4 and 2 x 8 studs, which in turn carried 6 x 8 timbers at the desired elevation to support the false floor. All false work was constructed so that it could be removed easily.

The two 25-ft. approaches were paved with concrete 6″ thick.

The 660 bags of cement used cost $429. The sand and gravel aggregates were procured within a few hundred feet of the project. These were mixed 1:2:4 in a Jaeger 1-bag mixer. A Caterpillar tractor and rotary scraper were used to remove gravel and sand in the creek channel. Lumber for cribbing and falsework was on hand from former similar projects. An average of 4 to 7 men were employed daily. Labor and supervision cost $733.64. The total cost, exclusive of reinforcing steel, was $1,257.69.

Minnesota Owns 438 Gravel Pits

The State of Minnesota is in the gravel business on a big scale, according to figures prepared for the biennial report of the Department of Highways. The state now owns 438 gravel pits, totaling 4,774 acres and situated in 69 counties. The estimated amount of material contained in these pits on July 1, 1944, was 13,086,000 cubic yards, purchased at an approximate cost of 2.7 cents per cubic yard. During the biennium the Department tested and surveyed 135 locations and purchased 33 gravel pits.

A total of 4,154,556 cubic yards of gravel was used by the Department's construction and maintenance divisions in the two-year period ended June 30, 1944. Of this amount 1,528,706 yards came from state-owned pits and 2,625,848 yards from leased pits. This does not include gravel furnished by contractors on projects where contract price includes all materials.

Adjusting Sewage Treatment to River Condition

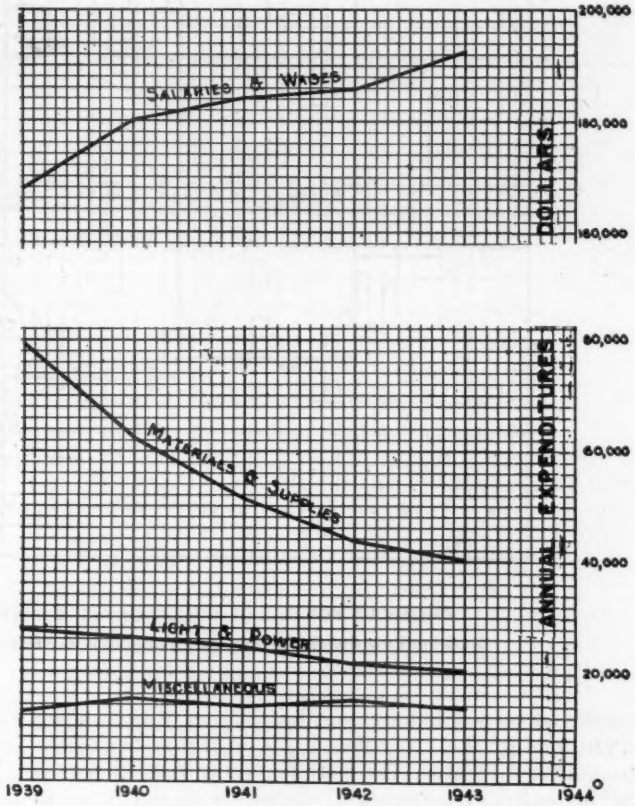
How the operator of the Minneapolis-St. Paul sewage treatment plant regulated the treatment by constantly varying the oxidizing capacity of the river rather than by maintaining the effluent at a fixed standard.

THE Minneapolis-St. Paul sewage treatment plant was constructed in 1934-38 for the purpose of so lessening the pollution of the Mississippi river as to eliminate nuisance conditions and prevent depletion of oxygen below that necessary for the preservation of fish life. There are numerous other sources of pollution both above and below the "Twin Cities," and it would be impracticable to attempt to restore the river to its pristine purity. The pollution content of the effluent from the plant which is permissible depends, therefore, upon the character of the water in the river and the dilution afforded by the volume of flow, both of which vary from week to week. During the year 1943 the river discharge, in cu. ft. per sec., varied from 5,625 in February to 44,420 in June; and before the construction of six headwater reservoirs the variation had been much greater.

Prior to the construction of this plant, each summer saw floating scum, sleek and large masses of sludge covering as much as 50% of the pool surface above the Twin City lock and dam, accompanied by extremely foul odors. During July, August and September, 1933, the B.O.D. of the river at this point averaged 7.15 ppm, the dissolved oxygen 0.40 ppm, the total bacterial count 1,200,000 per ml., and the coliform organisms 6,550 per ml.

It is considered that the minimum dissolved oxygen required for normal fish life is 4.0 ppm, and the plant is so operated as to prevent its effluent reducing the oxygen content of the river below this. The average for the summer of 1933 was 7.15 and the minimum was 5.90. During the same period the B.O.D. averaged 1.60 as compared to 7.15 in 1933.

With such a wide variation in dilution capacity of the river, there would be a corresponding change in the amount of purification required of the plant, and this was provided for in the plans. The plant was designed to be operated, and is being operated, with a view to keeping the operating costs at the minimum that will permit meeting the standard above referred to. It contains screens and grit chambers, six settling tanks, effluent filters, sludge concentration tanks, six vacuum filters, and three multiple-hearth incinerators. Provision is made also for chemical precipitation and chlorination.



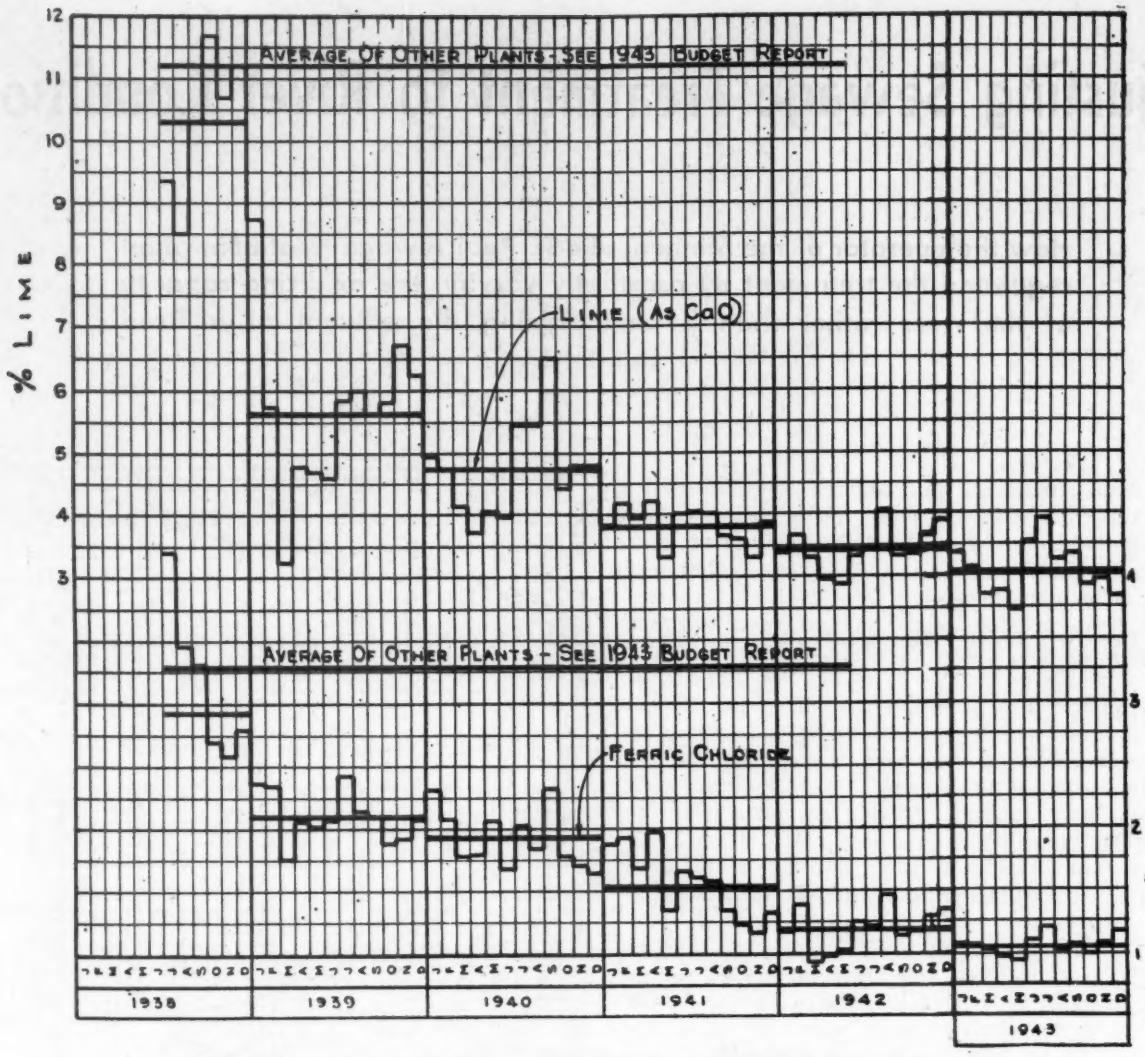
Showing the result of economies in operation.

More than a half of the operating costs of the treatment plant are required for vacuum filtration and sludge incineration, and the greatest saving in cost can be made in connection with these processes. Such saving can be effected in two ways—by reducing the amount of sludge to be handled, and by reducing the cost per ton of solids disposed of.

The former is attained by the operation of the sedimentation tanks. The capacity of the six tanks would have provided, during 1943, an average detention period of about 3 hrs.; but as operated, the average period was only 1.2 hrs. and the removal of suspended solids in these tanks averaged only 64.3% and of the B.O.D. only 39.5%. Chemical precipitation was not

Comparison of Costs of Various Items

	1939	1940	1941	1942	1943
Salaries and Wages	$167,928.91	$180,126.05	$184,085.04	$185,912.96	$192,704.59
Materials and Supplies	79,266.58	62,394.76	51,397.49	43,761.08	40,074.14
Light and Power	27,677.63	26,139.36	24,392.44	21,770.00	20,232.62
Miscellaneous	12,690.95	15,174.60	13,936.38	15,180.92	13,688.04



CHEMICALS FOR SLUDGE CONDITIONING, EXPRESSED AS PERCENTAGES OF DRY SEWAGE SOLIDS
Showing how chemical doses were continually reduced as improvements in plant operation were introduced.

employed at all, but during January to March, when conditions of the river flow made a higher degree of treatment desirable, the sedimentation was increased by increasing the period of detention in the tanks to 1.4-2.3 hrs. During the period from October to December, on the other hand, it was reduced to 0.8 hr. The per cent removal of suspended solids in the settling tanks averaged 69.2 during the former period as compared to 59.0 during the latter; the dry sludge averaged 127.9 tons per day during the former period and 93.7 during the latter, and the chemicals for conditioning decreased from 20,120 lb. of lime and 9,400 lb. of ferric chloride during the three former months to 12,680 lb. of lime and 5,320 lb. of ferric chloride during the latter.

The effluent filters were not used during the year.

In adjusting the treatment to the varying demands, the B.O.D. of the effluent ranged during the year from 76 ppm to 140 ppm and the percent removal from 33.5 to 41.1; the suspended solids from 70 to 120 ppm; and the settleable solids from 0.5 ml/liter to 2.3 ml/liter, the removal ranging from 65.5% to 92.5%.

In effecting economies by perfecting details of operation, the staff of the Minneapolis-St. Paul treatment plant have been and still are continuously developing and trying out procedures and devices. Some of these developments will be described in a later article. The success obtained in reducing costs is shown by the fact that the total operation and maintenance costs have been reduced from $292,473 in 1939 to $280,345 in 1943, although the amount of sewage treated has increased from 36,705.3 million gallons in the former year to 42,004.0 in 1943; or from $7.98 per million gallons treated to $6.70. Some of these developments will be described in a later article.

River Studies

There is no simple formula or schedule by which plant operation can be adjusted to river conditions to secure the result described above as the criterion, but laboratory analyses of samples collected regularly from the various units of the plant and from the river serve as a basis for proper control of operation. In 1943, 4,119 samples from the plant units were received at the laboratory and 905 from the river.

"The laboratory keeps a check on the condition of the river in order to determine whether the plant is performing the function for which it is intended, namely, the maintenance of satisfactory sanitary conditions in the river. The river data also serve as a basis for adjustment of plant operation according to the actual condition of the river from month to month, thereby avoiding unnecessarily high degrees of treatment of the sewage and providing the most economical method of operation consistent with maintenance of

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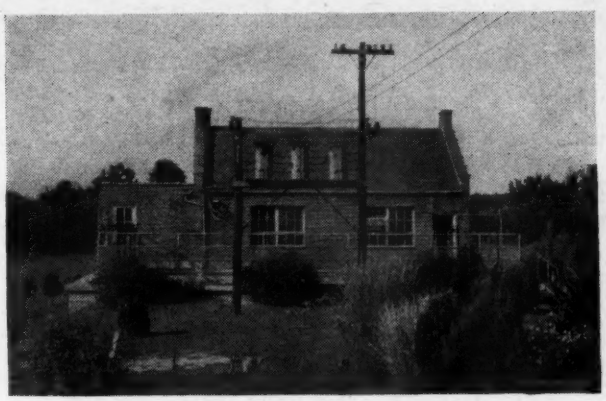
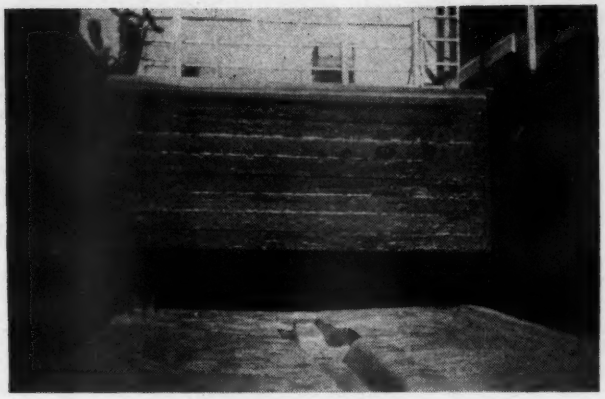


Waterwork building and grounds, Perryville, Mo.



View of baffle in tank.

Remedying Short-Circuiting in Sedimentation Basins

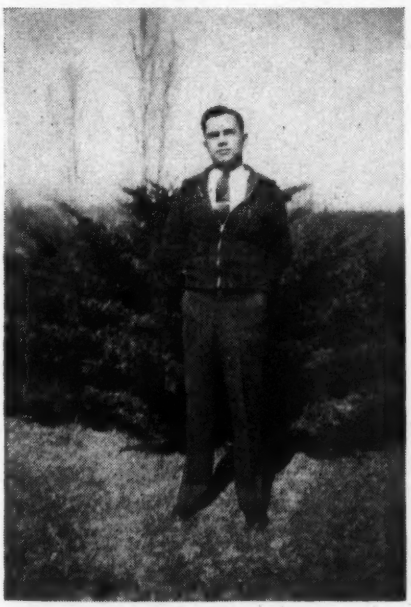
Reduction of nominal five-hour detention period to twenty minutes by short-circuiting remedied by baffles.

By NATHAN H. WEISS

Superintendent Water and Sewerage Dept., Perryville, Mo.

PERRYVILLE, Mo., has a population of about 4,000 and pumps an average of 180,000 gallons per day into its water distribution system. The water is obtained from Saline river, lime and alum are applied using a rapid mechanical mixer, it is passed through two sedimentation basins and rapid sand filters and disinfected with chlorine gas.

Some time ago we realized that there was short-circuiting across the top of the settling basins, and that, while theoretically the detention period was 5 hr. and 20 min., actually the greater part of the water crossed the basins in 15 to 20 min. Under these conditions the turbidity of the influent to the basins was 40 ppm and that of the effluent 30 ppm.



Nathan H. Weiss.

To improve this, we installed a baffle in each basin 3 ft. from the influent gate and extending to a depth of 7 ft., or 3 ft. above the bottom of the basin. After this change, the turbidity in the effluent was reduced to 2.9 ppm. The cost of installation was $40.50 for the 2" x 10" x 16 ft. baffle boards, and $35.00 for iron guides (made locally). We now get 35 to 40 hours longer filter runs and reduce the number of washings by two per month for each filter. As each washing takes approximately 1,900 gallons of water, we save 7,600 gallons per month, worth (at 25 cts. per thousand gallons to produce) $228 a year.

We also have increased the speed of our mixer from a 5:1 ratio to a 2.5:1, so that it now travels 100.4 ft. per minute instead of 50.2 as before. This has made a great improvement and is well worth the $111 which it cost to make the change.

Detroit Wants Civil Engineers and City Planners

The Detroit Civil Service Commission announces opportunities for Civil Engineers and City Planners in its various operating and planning divisions. These positions have induction salaries ranging from $2,760 to $4,830 per year, based on a 40-hour week. In addition, time and one-half is paid up to a limit of $1,000 per year, for work on the sixth consecutive day.

Residence rules have been waived for applications, and examinations are held daily in Detroit or may be arranged in localities convenient to the applicant.

Applications for the positions of head city planner and assistant director of city planning must be returned to this office on or before January 17, 1945. The salary of the former is $5,750 to $6,470; of the latter, $6,990 to $7,710.

Qualifications for successful applicants include education and experience equivalent to that customarily recognized as the professional standards at the various levels. Application information may be obtained from the Detroit Civil Service Commission, 735 Randolph Street, Detroit 26, Michigan.

The City of Detroit adheres to the Employment Stabilization Plan of the War Manpower Commission for the Detroit area.

Aeration of the Huddersfield Percolating Filters

Ponding was believed due to lack of air in the filter. Location of vertical aeration ducts at 10-foot intervals and use of a new type of filter medium are being tested as remedies.

THE sewage treatment plant of Huddersfield, England, treats about 11.5 mgd, of which 3.8 is domestic sewage from 135,000 population, 6.5 mgd is trade wastes and 1.2 mgd is infiltration. Sedimentation tanks have a capacity of 6,000,000 gal., bio-aerators 2,000,000 gal., percolating filters, 100,000 cu. yd.

The percolating filters pond through the accumulation of solids in the interstices. Lack of air circulation is believed to be an important cause of this, and an aeration duct has been designed which it is hoped will alleviate this trouble. These ducts would be placed at about 10 ft. centers throughout the filter. A trial of them is being made at the Huddersfield plant. Dr. H. H. Goldthorpe, sewage works manager, said last September:

"It is considered that the following advantages are possessed by these ducts:—

"(1) Increased aeration of medium.

"(2) Facilitates passage of macro-organisms to layers where growths are increasing.

"(3) Designed to prevent short circuiting of liquid.

"(4) Strong, durable and allows movement with ageing of bed.

"(5) Can be hosed or brushed to free from webbing, etc.

"(6) Direct washing of the floor of the bed.

"(7) Easily adapted to any depth of bed.

"(8) The cap on the duct prevents excessive air circulation and cooling.

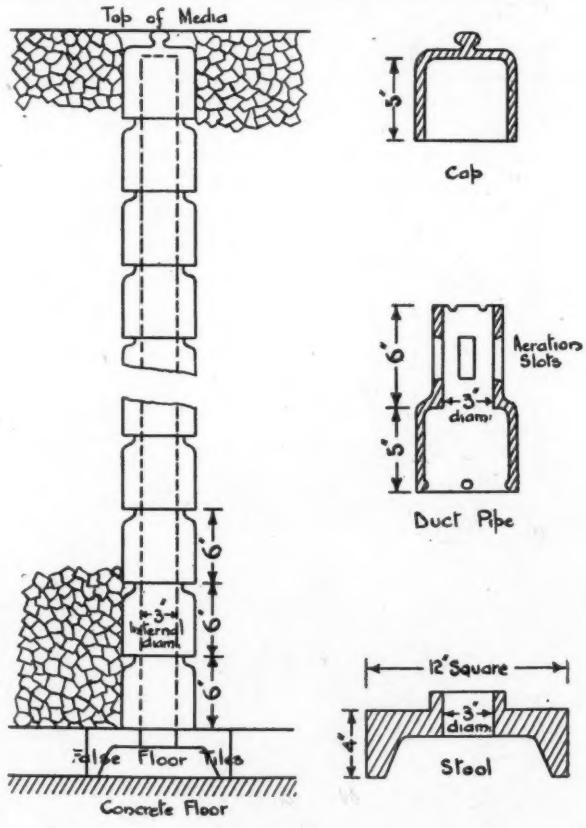
"The customary sewage works bed under normal British climatic conditions works on a counter flow principle, liquid downwards, air upwards.

"Gravitational forces give the water a good positive downward movement, but the forces giving the air an upward movement are weak, nil, or on very hot days may be negative.

"In order to give sewage a long contact with the medium, the passages for the water must be sinuous and the surfaces extensive. The weak forces moving the air through the beds are practically spent in overcoming the resistance through these tortuous, irregular passages. The aeration duct should serve to aerate the bed more effectively by a rapid clearance of the foul air, encourage macro fauna (particularly *Psychoda* at Huddersfield), which granulate the growths on the medium and yet leave the detention period for the liquor unchanged. At Huddersfield with *Psychoda* larvae as the principal agent for attacking the growths this duct should be particularly useful on a bed working at several times the normal rate.

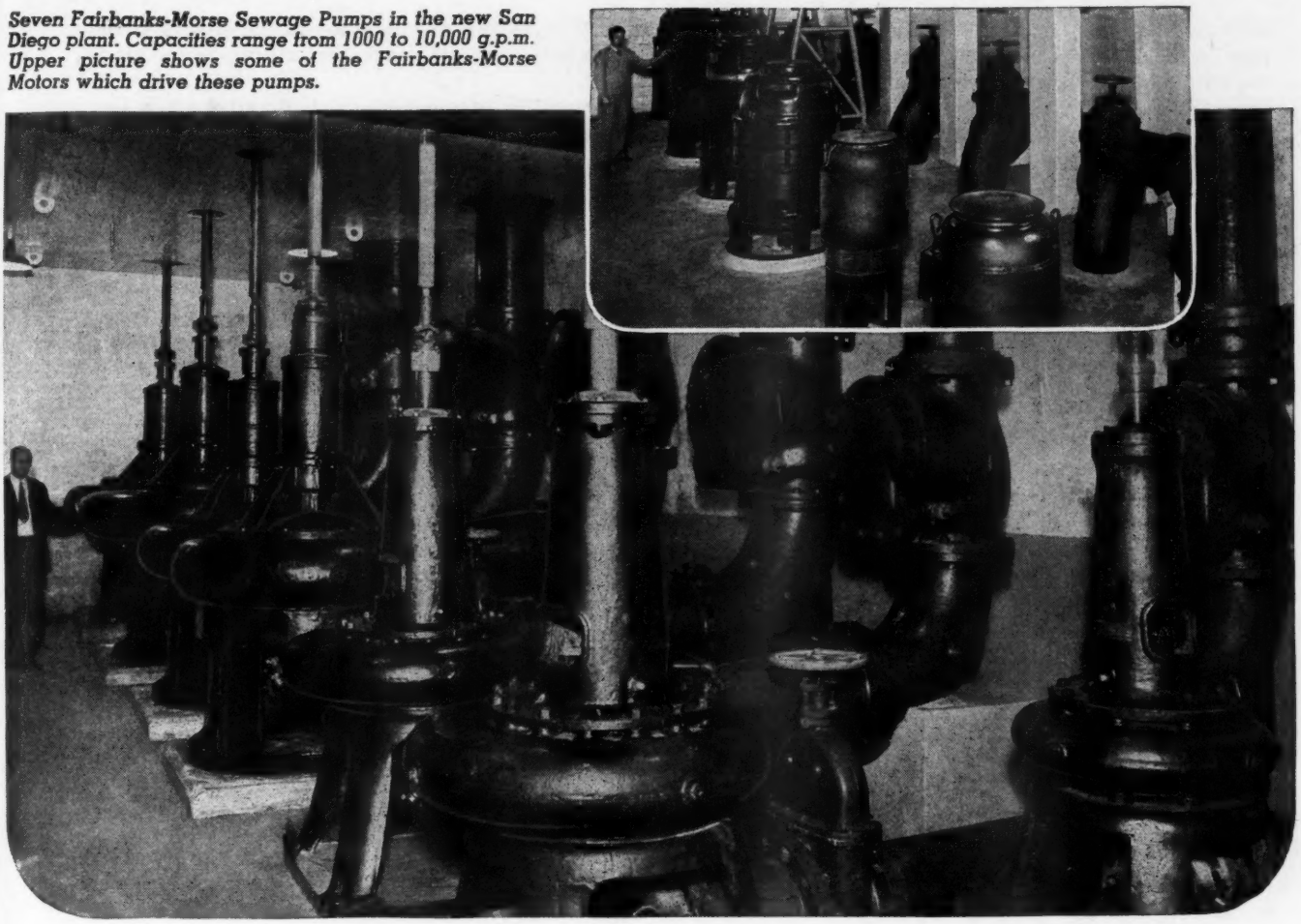
"The longer sewage is kept in contact with air and an active surface the greater will be the degree of purification. The degree of purification depends therefore on aeration and detention, *i.e.*, surface area and capacity to retain the sewage in shallow pools. The second half of the primary bed has been built up of horizontal brick channels and frogged bricks to observe the action of combined surface aeration in the channeled bricks and brick surfaces and the detention in the pools formed in the frogs of the bricks. The voids in this section are large to give as free a passage for the air as possible. The components of the filling are not ideal, but for trial have been chosen from material on the works.

"It appears that the action of a percolating filter could be improved or its high performance maintained if: (1) Air were given a freer passage through the bed. (2) Sewage were delayed in its passage through the bed by: (*a*) causing it to flow in thin films over horizontal surfaces, (*b*) retaining the liquid intermittently in shallow aerobic pools, not deeper than 1 cm. to allow larvae to browse on the submerged growth



The Huddersfield aeration duct for percolating beds.

Seven Fairbanks-Morse Sewage Pumps in the new San Diego plant. Capacities range from 1000 to 10,000 g.p.m. Upper picture shows some of the Fairbanks-Morse Motors which drive these pumps.



New San Diego Plant Uses Fairbanks-Morse Sewage Pumps

The San Diego, California sewage treatment plant, put into operation in July, 1943, was designed with a generous reserve capacity. But wartime conditions so quickly swelled the city's population, that already the plant has operated many times at near capacity.

Thus the new plant promptly demonstrated its ability to handle heavy loads. It has demonstrated its operating economy, too . . . the first 2,024 million gallons of sewage were treated for only $14.75 per million gallons. Sales of fertilizer produced—$120 worth per day—pay a considerable part of the operating cost.

Contributing to the efficiency and economy of the San Diego plant are seven Fairbanks-Morse Sewage Pumps, each driven by a Fairbanks-Morse Motor.

There are efficient Fairbanks-Morse Pumps for *every* municipal need, whether for sewage handling or for water supply. Let our pump engineers help solve your pumping problems without cost or obligation. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

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A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
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with the breathing apparatus in their tails at the surface of the liquid. The ratio of surface to capacity in the filling will need to decrease from the higher to the lower layers.

"The bricks used in the filling of the primary bed have frogs each capable of holding 125 ccs. water when the brick is level. By stacking them at 200 to the cu. yd. the holding capacity per cu. yd. will be about 5 gallons. Incidentally, at 200 frogged bricks to the cu. yd. the price compares favorably with metallurgical coke.

"This gives a holding capacity of about 3 per cent of a cu. yd., which approaches the 5 per cent water content of a cu. yd. of medium in a clean mature bed when working. Using 1½-in. bricks instead of 3-in. bricks, this capacity could be doubled and the 5 per cent exceeded.

"The filling of the bricked half of the primary bed is not entirely filled with frogged bricks, but a considerable number of channeled bricks have been included.

"A preliminary check on the clean media before dosing with sewage gave for the time of contact, using bio-aeration plant effluent at 720 gal. per cu. yd. and a salt solution:—

Coke	4 minutes
Brick	3 minutes

or a liquid content of:—

Coke	2 gallons per cu. yd.
Brick	1½ gallons per cu. yd.

"The bricks are laid according to the slope of the filter floor, *i.e.*, 1/36, but this does not account for the low holding capacity shown by the bricks in the salt test. Pools holding at least 100 ccs. of liquid on each brick are visible in the top three layers. The bricks are so arranged that the sewage descending flushes each pool in turn. The work continues.

"A special filter tile has also been designed, in an attempt to provide satisfactory aeration, and a positive period of detention. Each tile has an overall depth of 2 in., and it is intended to test their performance in a column 7 ft. high."

Recalcining Sludge From Water Softening

(Continued from page 23)

ously. But if it be sprayed directly into a flame as a mist, carbon dioxide is liberated and calcination completed instantly. Experiments with eight different forms of furnace were made by H. V. Pederson, superintendent of the Marshalltown water works, and in 1943 one was adopted for regular use. In this the flash-dried sludge drops into a hopper of a horizontal screw-type feed machine, which feeds it uniformly into the vertical feed chamber of a furnace 6 ft. 7 in. wide, 10 ft. long and 17 ft. high. The flame is supplied by three oil burners located at the bottom of one end of the furnace. As the sludge falls through the furnace it strikes splash plates set at an angle of 60° and is well dispersed. The temperature here is kept at about 2,000° F. The same heated air is then used for the preliminary drying. The calcium oxide is removed from two collecting wells at the bottom of the furnace by means of water-cooled screw conveyors and conveyed to a sacking device. This calcining furnace could handle 700 lb. per hr. of dried carbonate. It was calculated that 93% to 96% of the total available carbonate was converted into oxide.

This recalcined lime slaked readily in 120° preheated water, maintaining a slaker temperature of 140°; it gave an excellent floc in the mixing chamber of the softening plant and the settling in the clarifier was good.

Six or 7% of the total calcium carbonate is lost in centrifuging, but at the same time 80 to 90% of the magnesium and 30 to 40% of the iron is removed. Most or all of the remaining magnesium and iron collects on the sides of the furnace, for some reason, and falls off when the furnace cools after a day's run.

In tests conducted at the Wright Aeronautical Corp. plant, 93.8% of the calcium carbonate was recovered by the centrifuge, with a $CaCO_3$ purity of 93 to 97%, and 96 + % passing through a 325-mesh screen.

It is probable that this recalcining and re-use of sludge will be economical for plants producing 5 to 10 tons of sludge a day, but not for smaller plants if using a customary recalcining furnace. It is possible that much smaller plants would find it financially profitable if using a furnace similar to Pederson's, and Combustion Engineering Co. is studying possible refinements of the system with a view to having final designs ready for immediate postwar use.

City May Sell Surplus Water Outside Limits Without Losing Tax Exemption Status in Arkansas

A city which has constructed, on land purchased by it in a neighboring county, a lake and waterworks plant to supply the city with water, is not subject to taxation on the property by the authorities of such county, imposed on the ground that the city had entered the field of a public utility by also supplying water to two other cities and to a camp constructed by the United States Government because of World War II, and by constructing a swimming pool, bath houses, concessions and cottages below the dam forming the lake. (Yoes v. City of Fort Smith, Arkansas Supreme Court, 182 S. W. 2d 683.)

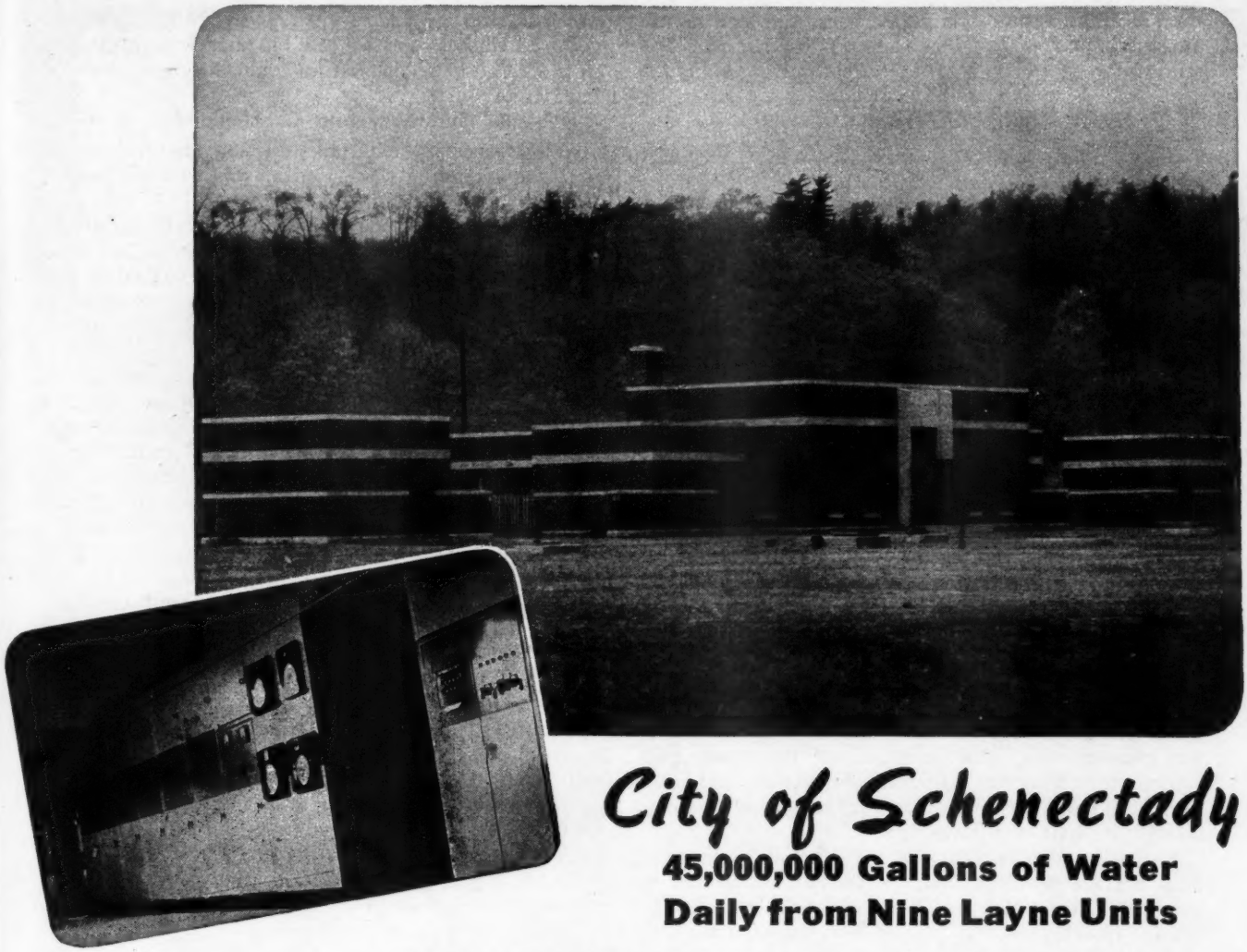
The city was Fort Smith, Arkansas. The lake was 25 miles distant from the city, in Crawford county. The municipalities supplied outside of the limits of Fort Smith are Alma and Van Buren. In 1935 the Arkansas Supreme Court had before it the contract by which Fort Smith sold Alma surplus water and then decided (191 Ark. 643) that the city had power and authority to sell its surplus water outside the city limits.

A city, the Arkansas court now holds, may sell surplus water without losing its right to tax exemption as public property used exclusively for public use.

The 27-inch pipe from the lake to Fort Smith passed through the city of Van Buren. In 1936 Fort Smith made a two-year contract with the Van Buren Improvement District to sell surplus water to the district. This service is still continued on a month-to-month basis. Except as to this, the situation as to Van Buren was the same as in the case of Alma.

Camp Chaffee is a large Army camp about 15 miles from Fort Smith. The city contracted with the Government to furnish water to the camp. The city, it is held, did not lose its tax exemption as having "entered the public utility field" by constructing a line to a camp which is not used exclusively for "public purposes," the camp having been built and being used for a public purpose in the broad national sense.

The swimming pool was built in a hole in the creek to overcome temptation to sightseers to swim in the lake. The city has never made any profit from it or its accessories. The court holds that the area below the



City of Schenectady

45,000,000 Gallons of Water Daily from Nine Layne Units

Now it can be told! Late in 1942, the city of Schenectady faced a major water crisis. The impetus of new war industries and the increase in the number of people to serve, sent the demand for water to new high peaks. The old system was so over-burdened that their reserve supply was diminishing a million gallons daily.

And then to Layne came an all inclusive contract—wells, pumps, electrical equipment and other essential apparatus. Schenectady could not afford to indulge in divided responsibility.

Layne New York Company put full crews on the job and in record time two wells were completed, giant pumps were installed and rushed into service. Shortly thereafter, the other seven were ready, giving Schenectady 45,000,000 gallons of clear, cold and sterile water daily,—and at a saving of $10,000 a year on operating cost.

Though constructed at extraordinary speed, these Layne Wells and Pumps were perfect in operation and met guaranteed efficiency. No other firm in America,—or perhaps in the entire world could have matched Layne's overall performance.

Layne Wells and Pumps are world's finest in rugged quality, superior design, high efficiency and long life. Layne can solve your water supply problems. For literature address Layne & Bowler, Inc. General Offices, Memphis 8, Tenn.

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—fulfill every need for producing large quantities of water from wells, streams, mines, or reservoirs. Their high efficiency and long life quality is recognized the world over. Send for late literature.

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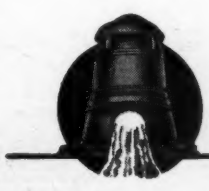

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dam is in the nature of a public park, and maintained for public purposes, and so exempt from taxation. The use of the property below the dam, as a swimming pool, bath house and public park, did not destroy the status as tax-exempt property.

Experiments With Stabilized Sand and Gravel Bases

(Continued from page 15)

Failures (exposure of the subgrade) began within a few days on the 1″ mixture and appeared later on the others up to 4″ thickness, approximately at periods inversely as the thickness, being small and scattered on the 4″ at the end of two years.

After two years of use, the thinner sections were rebuilt to 4″ thickness and all sections were brought to true surface, and a cut-back asphalt prime coat (MC-1) was applied at the rate of 0.20 to 0.25 gal. per sq. yd. This was followed by an application of 0.31 to 0.34 gallon per square yard of RC-2 cut-back asphalt and covered with 23 pounds per square yard of gravel having a maximum size of three-eighths inch. The surface was then broomed and rolled.

Seven days after the first gravel cover was applied the surface was given a second application of RC-2 material at the rate of 0.25 gallon per square yard and covered with sand at a rate of 12 pounds per square yard. This was followed by brooming and rolling. The resulting bituminous surface was approximately one-half inch thick.

Extensive displacement and shoving of the bituminous surface developed on one section, which had a sand-clay base which had been thickened with additional sand-clay, due to lack of bond between the old and new base material.

After 1 year of service cracking and breakage of the bituminous surface began to develop on all sections except those having a base course 6 inches or more in thickness. Practically all failures were at the edges or within the outer 6 feet, where the base thickness was often found to be less than 3 inches. One section with a 3″ base was completely destroyed after 4 years of service; and six other sections having base courses with average thicknesses ranging from 4.2 to 4.8 inches were approaching destruction. Slight deformation and "alligator" cracking had started in the outer 6 ft. on both sides of another section which had an average base thickness of 6.2″. Where the base was 8″ thick there was entire freedom from failure. Where the old bituminous mat had not been removed, conditions were in general similar to those in sections about 2″ thicker under which the old mat had been removed, indicating that the old mat was equivalent in traffic service to at least an equal thickness of stabilized base.

Summary and Conclusions

With respect to materials and methods of construction, the foregoing discussion may be summarized as follows:

Heavy clay soils may be combined with granular material to produce stabilized mixtures of uniform quality by means of the mixing plant described in this report without any previous preparation such as drying and pulverizing generally required in ordinary road-mix methods of construction.

Neither the origin nor the chemical composition of the binder soils used in this experiment had any influence on the performance of the stabilized mixtures. For equal proportions of binder soil and granular material, the liquid limits and plasticity indexes of the resulting mixtures varied in accordance with liquid limits and plasticity indexes of the binder soils regardless of their source, organic content, or lime content.

A definite increase in compaction (approximately 4 percent) under the action of traffic was observed during the first month following construction with practically no increase thereafter.

Calcium chloride in the amount used integrally on this work (0.45 percent by weight or approximately 1 pound per square yard for a 2-inch layer) was not sufficient to maintain the surface in a moist condition during the hot, dry weather characteristic of the construction period. Additional applications of calcium chloride (about 0.5 pound per square yard) after light rains or sprinkling helped considerably towards maintaining a smooth surface.

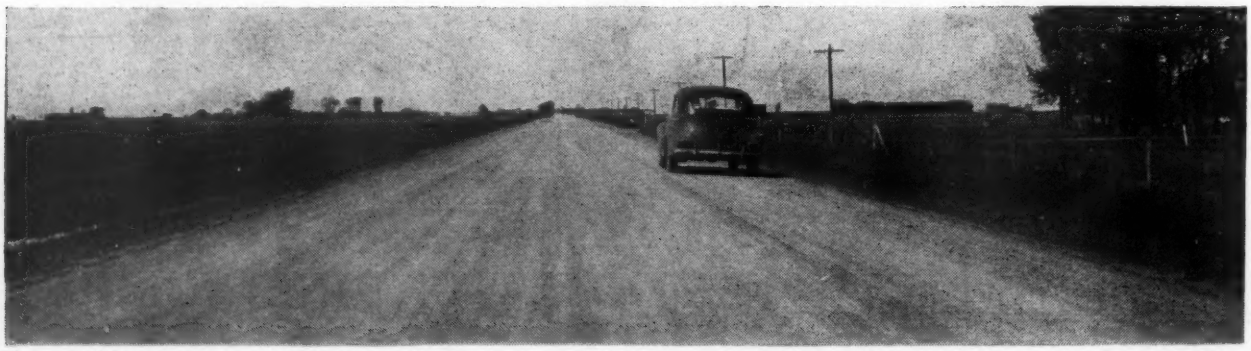
The following conclusions appear justified on the basis of the performance of the various test sections prior to construction of the bituminous wearing surface.

Surface defects such as corrugations, raveling, pitting, scaling, and potholing occurred on all sections regardless of thickness or physical properties of the mixtures. Resistance to abrasion on sections having plasticity indexes from 7 to 10 was no greater than on the sections having plasticity indexes of 4 to 6.

Surface wear resulting from the action of traffic amounted to about three-fourths inch per year.

A stabilized layer 1 inch thick cannot be satisfactorily maintained as a surface course when resting on the heavy clay typical of this road.

A 2-inch wearing surface on the heavy clay is likely to be worn out completely after 1 year of service owing to the fact that following the loss of 1 inch by traffic



Surface free of failures during four years of service.

MAKE THIS TEST

OF ABRASIVE SKIDPROOFING VALUES

The answer to the icy road problem is to get effective skidproofing in the shortest possible time.

Calcium chloride treated abrasives are so widely used because they stick quicker to icy road surfaces. Calcium chloride also serves to keep abrasives unfrozen so they may be loaded and spread easily and rapidly.

You can test the comparative effectiveness of calcium chloride treated abrasives against untreated abrasives very easily. Wet two boards the first cold night to let them freeze to a glare ice surface. Get a handful of abrasives that have been *out in the freezing weather* without treatment and place it on one of the boards. Place a handful of abrasives, treated with calcium chloride, on the other board. Let them alone for five minutes, then tilt the boards. Note how much of each slides off. Then brush them and see how much effective skidproofing material is left.

This test will show why the skid resistance of ½ lb. of calcium chloride treated abrasives per sq. yd. is as much as that of 1½ lbs. of the same abrasives untreated—why you save by treating abrasives with calcium chloride.

Write for Bulletin No. 27, "Skidproofing Icy Roads and Streets," covering methods of application and amounts to use. Calcium Chloride Association, 4145 Penobscot Bldg., Detroit 26, Mich.

ICE CONTROL WITH

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FAST · POSITIVE · ECONOMICAL

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abrasion, the remaining 1 inch may soon be displaced in the manner described for section 1.

Stabilized sand suffers greater losses from abrasion than stabilized gravel.

The behavior of the reconstructed test sections when used as a base course seem to warrant the following conclusions:

A thin bituminous wearing surface such as the double blotter type seal requires a base course having a thickness of at least 8 inches to provide adequate support under the conditions of traffic, climate, and soils typical of this road.

With respect to the use of thicker bituminous surfaces, it was indicated that a re-treatment might have prevented the slight deformation and cracking starting to occur on section 7, which had a base thickness of 6 inches. The performance of the test sections constructed on the old bituminous mat, which was approximately 2 inches thick, suggests that a combined thickness of wearing course and base course amounting to 8 inches is required to give satisfactory service on the highly plastic clay soils of the Red River Valley. There was no definite indication that a lesser thickness would prove adequate on the relatively less plastic, lighter textured soils found on the eastern portion of the experiment.

It was clearly demonstrated that the service behavior of a stabilized sand base course was equal in every respect to that of a stabilized gravel base of the same thickness.

This article was prepared from information and photographs furnished through the courtesy of the Public Roads Administration.

Equipment for Placing Concrete Pavements

(Continued from page 21)

wheeled barrows are loaded in the cement car by hand, trundled onto a scale, weighed, then dumped into batch trucks or industrial railway cars. A crew of 5 or 6 men can keep a 27-E mixer supplied with hand-batched cement.

Aggregate should not be stored upon the subgrade, for this prevents the proper preparation of the subgrade, makes accurate measuring difficult, and earth is likely to be shoveled up with the aggregate. A central proportioning plant, from which proportioned batches are hauled to the mixer, is desirable.

At the plant there will usually be storage piles for sand and stone, a cement warehouse and elevated aggregate bins. Whenever possible, materials are lifted to the elevated bins directly from the railroad cars or trucks in which they are shipped. The storage piles are used only to assure a continuous supply, to afford an outlet for a temporary excess of material, or to equalize moisture content.

The site for a storage pile should be cleaned of all debris and weeds and, if possible, rolled before any aggregate is deposited. Every precaution should be taken to prevent (1) getting earth mixed with the materials and (2) segregation of materials. A layer of material is left at the bottom of the pile until the completion of the job, when it is carefully picked up with stone forks. No material that shows a trace of earth should be allowed to go into the pavement, for it may seriously affect the durability of the slab.

Trucks. The number of trucks required is dependent upon the size of truck and length of haul. A two-batch truck is probably the most common in use, although four-batch trucks are used on many large paving projects. Assuming a 2-mile haul and the use of a 27-E paver, there would be required ten trucks to keep the paver in continuous operation. Each additional mile of haul would require about 3 more trucks.

Water Supply. Water must be supplied to the mixer, for wetting the subgrade, and in some cases for curing. The mixer will take about 35 gallons per batch, or about 1700 gallons per hour for mixing. It is advisable to be able to supply a total of at least double that amount to take care of all the water requirements.

Forms. If forms are used for the edges of the pavement, a large enough supply for three days' run is necessary. This will take care of the forms for the preceding run, the day's placement, and allow forms to be set in advance for the following day.

With a 27-E paver and an 18-foot slab (half of a 36-foot pavement), this would indicate the need of 6,000 lineal feet of forms, while for a 34-E dual-drum mixer there would be required 10,000 lineal feet.

Machine-Finishing. Finishing machines are used on nearly all country road pavements, the few exceptions being in mountainous country where curves and the attendant widened sections make machine-finishing impracticable. Finishing machines now are made with a wide screed that not only gives the concrete its proper contour but consolidates it by pressure. Or there may be two screeds, the front screed being set 3/16 in. high to allow for consolidation by the rear screed.

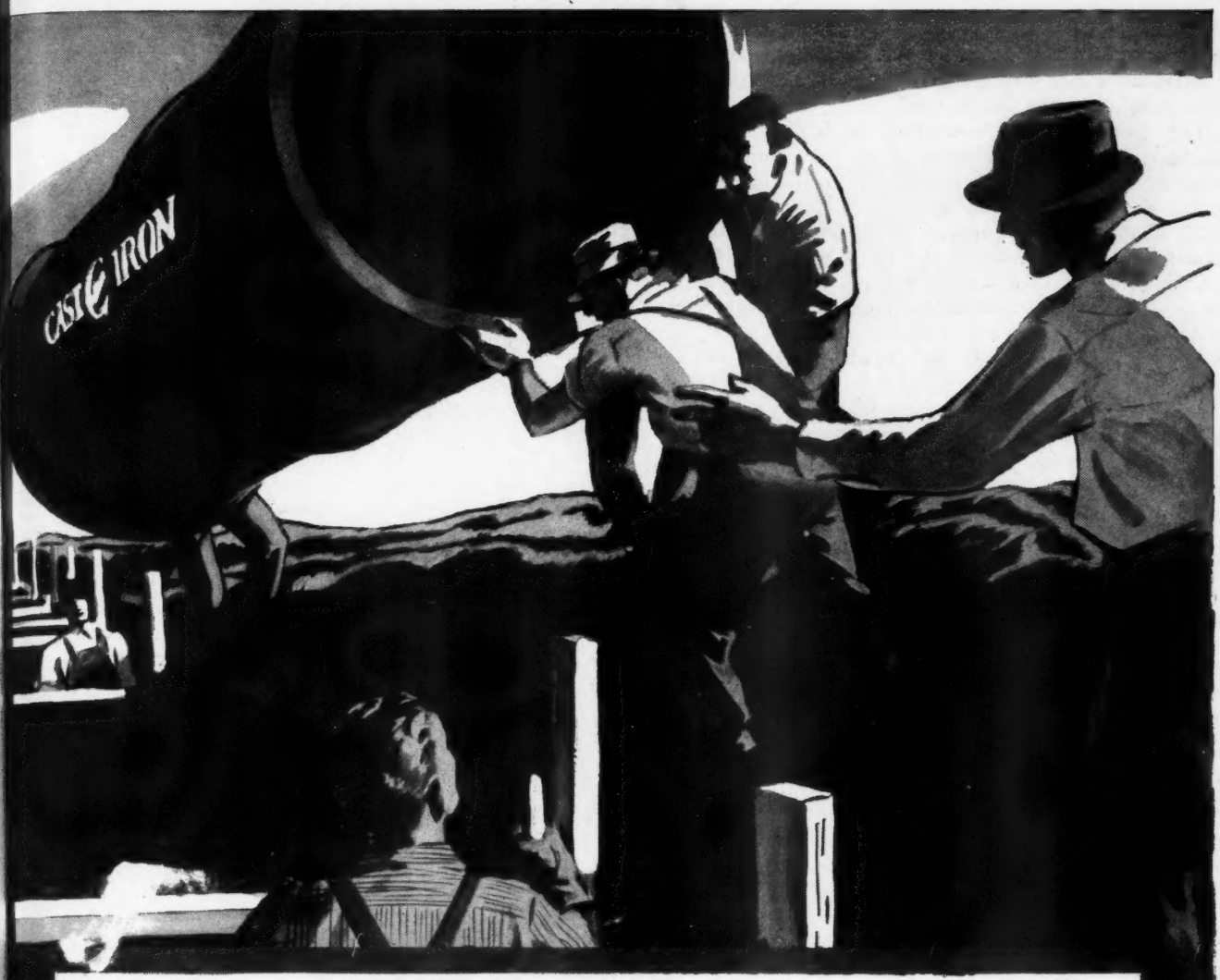
Finishing machines are growing more popular by city work, where they are used on the central slabs, or sometimes for the whole pavement. Forms are set at the required distance out from the curb to serve as a track for the finishing machine. Deformed metal plate is welded to this form to make a groove in the edge of the slab for a tongue-and-groove joint.

Rapid vibration has been used experimentally in several states as an aid in consolidating concrete pavement. Data from tests conducted by engineers of the Bureau of Public Roads indicate that a saving of approximately 10 per cent of the cement can be effected by the use of vibration without a reduction in strength or uniformity. Conversely, if the cement content is held constant, a 10 per cent increase in flexural and compressive strength can be obtained.

In most states the finishing machine is followed by a float from 12 to 16 or even 20 ft. long, operated with its long axis parallel to the center line of the pavement. It is made of a plank 2 to 3 in. thick and 6 to 10 in. wide, stiffened by a plank set on edge along the top, and provided with handles at each end. This longitudinal float, as it is called, is handled by 2 men who stand on bridges spanning the pavement. It is laid on the pavement at one edge and pulled toward the other edge with a wiping motion, leveling transverse ridges and other high spots and filling depressions. The longitudinal float is an efficient tool for getting a smooth riding surface because it eliminates the transverse ridges sometimes left by screeds or belts, and any ridges it leaves are longitudinal and do not produce bumps. Mechanical longitudinal floats are widely used.

Following longitudinal floating, the surface is scraped with a straightedge on a long handle.

The next operation is straightedging. A straight-



THE 10 REQUIREMENTS FOR UNDERGROUND MAINS

LONG LIFE: In evaluating bids, the useful life of cast iron pipe is figured at 100 years minimum.

FLOW CAPACITY: Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

TIGHT JOINTS: For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—have stood the test of time and are known to be leak-proof.

TENSILE STRENGTH: Routine specimens cut from standard cast iron pipe show tensile strength ranging from 23,000 to 30,000 pounds per square inch.

BEAM STRENGTH: Under beam stress tests, standard six-inch cast iron pipe bears up under a load of 17,500 pounds and deflects approximately 1½ inches before breaking.

TOUGHNESS: Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one foot with one-foot increases.)

INTERNAL PRESSURE: An average of many internal hydrostatic pressure tests on standard six-inch cast iron pipe shows this pipe withstands more than 2500 pounds pressure per square inch.

EXTERNAL PRESSURE: In regulation compression tests on a 12-inch section, standard six-inch cast iron pipe withstands a crushing weight of 14,000 pounds.

IMPERVIOUSNESS: The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal pressure tests.

TAPPING: Cast iron pipe can be tapped cleanly with strong, tough threads, losing little in structural strength.

Other pipe materials meet some of these requirements but only cast iron pipe meets them all.

CAST IRON PIPE SERVES FOR CENTURIES

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edge about 10 ft. long mounted on a long handle is held so that it barely touches the concrete. This is done at intervals of 3 or 4 ft. transversely, with the straightedge parallel to the center line.

The final finishing operation is belting, which should be done after the water sheen has disappeared from the concrete. A belt of rubber, fabric, or a thin board, about 10 in. wide and 2 ft. longer than the width of the pavement, is laid on the pavement transversely and dragged forward with a sawing motion.

Curing materials also must be furnished. In normal times there are several methods of curing concrete pavements. They may be ponded if sufficient water is available; may be covered with earth or straw which is kept wet during the curing period; or covered with impervious paper or curing compounds. Any of these methods is acceptable, but enough must be supplied to keep all the pavement covered during the curing period.

Ready-mixed Concrete. When there is a good central mixing plant in the vicinity, there is no reason why it cannot furnish as good concrete as can be mixed on the job. In deciding whether to use ready-mixed or transit-mixed concrete, availability of equipment for on-job placement and the cost of the ready-mixed concrete are generally the determining factors for large projects. For small projects such as curb and gutter, manholes, catchbasins, etc., the use of ready-mixed or transit-mixed concrete might be economical and otherwise advantageous. In mixing small quantities in a portable mixer there is usually unavoidable waste of aggregates and idleness of labor, and it is difficult to secure as accurate a proportioning of the mix.

Equipment for small concreting jobs will be discussed in a later issue.

Using an Elevating Grader in Cleaning Road Ditches

By H. C. SWORD
County Engineer of Richland County, Ohio

ONE of the most difficult problems besetting the average county engineer is to keep the road ditches in the proper condition so they will function normally as designed for the ultimate all-year benefit for the paving surface itself.

To the average layman this would seem like a very simple operation and under certain circumstances that may be the case. However, the riding public normally uses only the paved surfaces of the road and to them the side road ditch is only an unimportant adjunct to the payment itself. Inasmuch as they are striving primarily to use the paved surface, whether it be for a passenger car or truck, their criticism or demand on the county engineer is solely in terms of keeping this pavement in travelable condition for their own safety and a longer life for their car.

The greater part of the mileage that the county engineer is responsible for is in the rural areas, and the demands of the owners of the adjacent farm land for proper outlets for their fields is a constant prod upon the engineer not only to meet surface outlets but subterranean as well. The engineer is aware at all times that good drainage is one of the prime requisites to keep any highway in proper condition.

At any and all times the real limit as to how far a county engineer can go in satisfying the public who use the road and farm its boundaries is the finances granted or monies available to perform maintenance in an efficient manner.

This all brings us down to the real problem of berming and ditching a sufficient number of miles in one season so that the operation can be repeated as soon as it is really necessary. In our case, with 375 miles of county roads to maintain, it was obvious that only a limited proportion of these could be ditched and bermed with hand loading in the limited season this work is feasible in northern Ohio. Also, experience proved that front-end loaders, though far superior to hand loading, had certain limitations which prevented accomplishing our goal in sufficient amount of mileage to meet drainage requirements.

In August 1943 Richland County purchased a used Model 11 Adams elevating grader from the T. V. A. used equipment brokers, after it had been in service over a year on earth work construction near Lenoir City, Tenn. It was bought equipped with steel wheels, 48" carrier 25 feet long, and a 68½ h.p. Diesel engine. We found in a short time that the width of our roads would not permit the operation of a 25-foot carrier and consequently a section was removed reducing the length to approximately 19 feet. This grader was pulled by an 85 h.p. Diesel motored Cletrac tractor which seemed capable of doing the job under all conditions.

At all times we had sufficient labor to remove and replace drain pipes under side drives, mail boxes and other physical objects. A certain amount of hand dressing was required where the grader detoured from a straight ditch alignment in approaches to and departures from such objects. Trucks were furnished in sufficient numbers to guarantee this feature. The shorter the haul and the more accessible the discharge point, the less was the number of trucks needed. The continuity of the operation did not require more than 60% more trucks than was required under the older mode of operation, and this increase in trucks was offset by an increase of 400% in the amount of dirt removed. This continuity of operation left the road at the end of a day's work without any objectionable windrows such as usually are left under other operations, the maintainer berming and ditching a windrow in advance of a day's operations for the loading crew. With hand loading, if bad weather occurred, it was impossible to remove a windrow until weather permitted, and naturally traffic would complain at this driving hazard.

This increase in rate of dirt handling will make it possible for Richland County Highway Department to ditch and berm its 375 miles of roads at least once every three years, whereas former facilities would not allow us to accomplish the complete overall job in less than 11 years, using all the available time the season would allow.

The money saved in operations and the better feeling among property owners whose fields benefit are a part of the overall picture, but the engineer especially appreciates the protection which satisfactory drainage furnishes.

Construction of this twin-arch bridge near Moorestown, N. J., was simplified and speeded through use of ARMCO Multi Plate. Each arch has a span of 22 feet and is 40 feet long.

SAVE DAYS AND DOLLARS with "PACKAGED" POST-WAR BRIDGES

V-Day will sound the go-ahead signal on many long-needed small bridge projects. Future-minded engineers are making detailed plans now to replace weakened structures and extend narrow bridges for greater traffic safety and road budget economy. Naturally they are looking at improved methods and materials with a careful eye.

Multi Plate Speeds the Job

You can simplify and speed construction of small bridges, culverts and large sewers by using ARMCO Multi Plate. Assembling and bolting are practically as simple as changing an automobile tire. The easily-handled, pre-curved corrugated metal plates are nested together to save space in shipping, hauling, handling and storage. Unskilled men easily and quickly install your "packaged" structure with the simplest equipment and small tools.

The Multi Plate "form" is the completed structure. No curing, no waste, no delay. Other operations go faster too.

Now is a good time to write us for complete details about Multi Plate. Armco Drainage Products Association, 75 Curtis Street, Middletown, O.

MULTI ARMCO PLATE

Armco Multi Plate

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Twenty-two

Reasons Why *FLEX-PLANE* Dummy Joints are Necessary in Modern Concrete Pavements

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- More Dummy Joints Divide Contraction Openings
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- Reduces Curling
- Relieves Stress
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- Minimizes Pumping
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- Lessens Deterioration
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- Anchored in Place — Is Permanent
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- Localizes Expansion and Contraction
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- Prevents Infiltration of Water
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- Provides Expansion Relief for the Hot Upper Part of the Slab

FLEX-PLANE joint installing machines eliminate messy hand methods. Install all types of joints . . . ribbon, poured, premoulded, etc., with or without VIBRATION.

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Objections to Wide Right-of-Way

Not all highway officials are in favor of wide rights-of-way, or of landscaping the roadsides. At the recent meeting of Association of State Highway Officials, where this subject was discussed, several of the members explained their disagreement with widely publicized pleas for these features. W. K. Beckham of South Carolina argued that rights-of-way extending considerably beyond present requirements withdraw unnecessary amounts of land from cultivation and add materially to the cost of maintenance. He favors, instead, taking easements where it seems probable that additional width may be needed in the future. South Carolina enters into agreements with farmers for the cultivation of unused rights-of-way in agricultural areas, and in forested areas they do not clear more land than is needed for present traffic and maintenance. In Iowa, also, the State Highway Commission does not favor taking wide rights-of-way in fertile areas, but takes easements for land required for post-war projects and lets the farmers cultivate the land until the state is ready to use it.

Concerning landscape planting of trees along highways, L. F. Johnson, of the New Hampshire Highway Dept., said that his state does not favor formal planting in rural areas, as it adds to maintenance costs; moreover, imported trees do not survive so well as native ones, but they encourage native plants and shrubs, and forest trees up to within about 20 ft. of the side ditches. Minnesota, also, opposes landscaping, chiefly because the trees and shrubs greatly increase the amount of hand work required in mowing. They take a minimum of 150 ft. of right-of-way, and seed the sides to grasses which the farmers are willing to cut for hay.

Municipalities' Liability for Manhole Covers

The Pennsylvania law as to a municipality's duty to maintain in good condition its sewer covers on sidewalks or cartways is that it ordinarily has no duty to make inspections to discover defects and is only required to be vigilant to observe the defects when they can be seen by one of its officers exercising reasonable supervision. To make the municipality liable for injuries caused by a sewer cover on a sidewalk, the actual or implied notice of the existence of the defect must be shown. But if the character of the defect indicated that it should have been known that deterioration, dilapidation or decay causing the defect were the natural and ordinary consequences of the construction employed, the mere absence of notice will not relieve the municipality from liability. The municipality then has the affirmative duty of making reasonable periodic inspections.

In an action against a city for injuries caused when the plaintiff jumped on a concrete manhole cover from a truck and the cover gave way, the Pennsylvania Superior Court (Siger v. City of Pittsburgh, 39 A. 2d 296), stating these rules, held that if the plaintiff had shown that the absence of a metal rim would cause a gradual deterioration and chipping of the concrete and that a sufficient time elapsed from the original construction in 1937 or the last inspection, if any, to require a more recent examination, proof of the fact that the lid tilted when stepped on by a pedestrian would have taken the case to the jury; but, in the absence of such evidence, a judgment denying the city's notice for a judgment notwithstanding a jury's verdict for the plaintiff was reversed and judgment entered for the city.

Isn't this the answer to

YOUR HIGHWAY PROBLEMS

NOW... and for 194X, too?

Now that the Government has given the "Go" signal on much-needed highway maintenance and repair work, the Tarvia distributor is again a familiar sight in many states, counties and municipalities anxious to get the most from their current appropriations.

But what about post-war plans? The time left to complete your V-E and V-P Day programs is growing shorter every month—every week.

Why not discuss your problems with the Tarvia Field Man? He has at his command all Barrett's 39 years of successful paving experience. He can show you how Tarvia, *plus* local materials, plus *local* labor, fits into any well-integrated highway system.

With Tarvia you can not only repair and maintain almost any type of existing road, but you can also build miles of new, long-lasting, easy-riding, skid-safe highway—quickly, economically and with uniformly satisfactory results.

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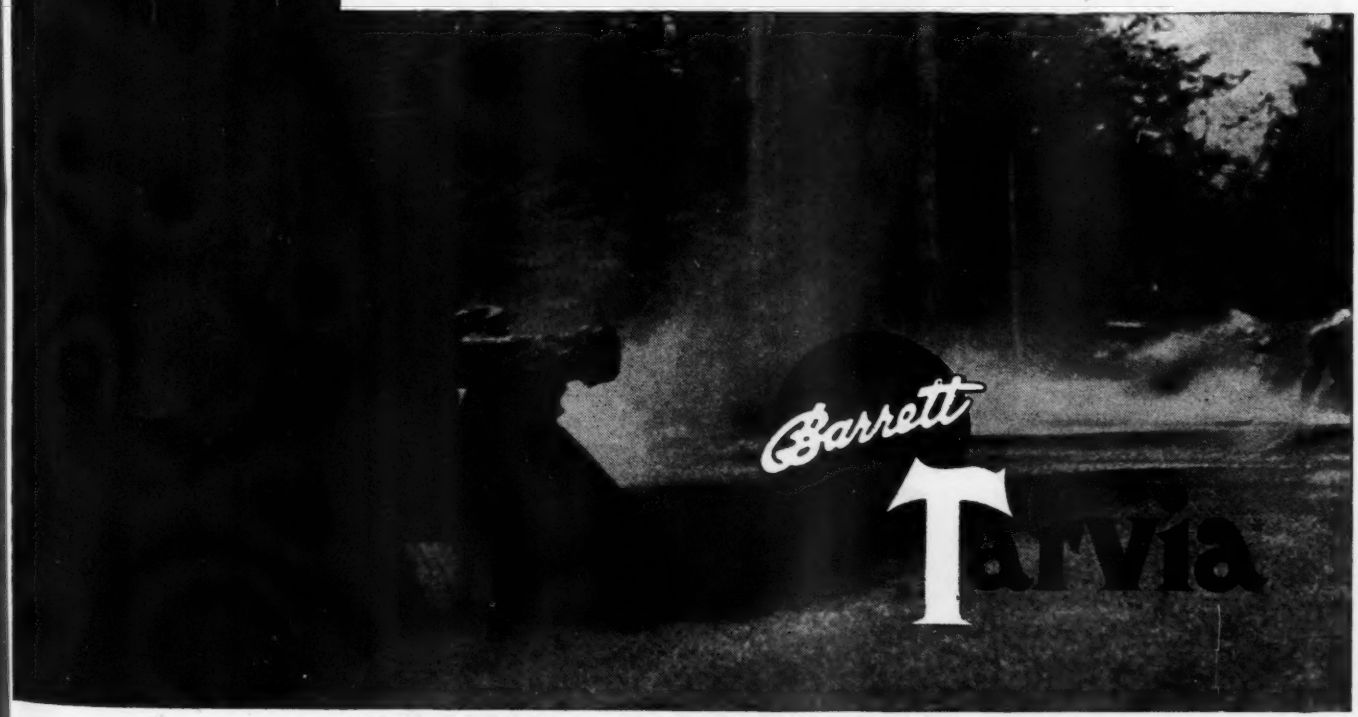

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 67-69*

The Pennsylvania Court recognized that there are cases (cited by the plaintiff) in other states in direct conflict with what the Pennsylvania courts have laid down as the rule fixing liability under similar facts.

War Changes a Sewage Plant

(Continued from page 16)

filters, the sewage flows through Dorr final settling tanks to the river.

Plans Proposed

The plans of the U. S. Army Engineers called for a dike to be built around the plant at elevation 1,040, and the construction of an additional pumping station to raise the sewage and the drainage from the plant site into the reservoir during high lake levels.

The plan designed by Blum, Weldin & Co. and the Chester Engineers, and the one adopted by the city, was briefly as follows:

1. The construction of a dike to elevation 1,036 for immediate protection, and the filling of the whole plant site to raise it from 4 to 6 feet, enabling all surface water to run off into the reservoir and eliminating the pumping of this.
2. The raising of the screen building and the pumping station to conform to the new ground level and to preclude any possibility of flooding.
3. The removing of the sludge beds from low ground to a higher site adjacent to the plant.
4. The removal of 5 feet of stone from the trickling filters and the substitution of motor driven rotary distributors for the laterals and fixed nozzles.

This latter design permits the effluent from the Imhoff tanks to flow by gravity onto the trickling filters and thence through the final tanks into the river, thus eliminating all pumping during periods of low lake level. When the reservoir is above elevation 1,020, the final tank effluent will be carried by gravity back into the present pumping station, and the present pumps, freed of their duty of pumping from the Imhoff tanks to the filters, will be used for pumping final effluent into the reservoir. This scheme will afford considerable power savings.

Construction

Plans were hurried and on August 19, bids were received on Contract I. This included construction of the dike, filling of the plant site, construction of sludge beds, sewers and drains, and the removal of stone from the trickling filters. The low bidder was Albinson & Co. of Minneapolis, and the contract was awarded to them.

Over 50,000 cubic yards of dirt were moved as fill during this contract, being obtained by excavating a large drainage ditch around the plant. This ditch carries into the reservoir a large amount of surface water from the surrounding area which formerly drained onto the plant site. The stone of the trickling filter consisted of 9 feet of 2- to 3-inch limestone, with a top cover of one foot of granite to prevent the weathering of the limestone. It was necessary to remove and store this foot of granite, remove five feet depth of limestone, amounting to 11,000 cubic yards, and then replace the foot of granite. Stone removal was accomplished by means of a shovel working on mats in the filter.

The winter of 1942-1943 came early and the temperatures were continually low. The dike proper was

Why "Part Time" Sewers?

A clogged sewer that is delivering only a fraction of its carrying capacity is not giving your citizens their money's worth. And it is exposing them to dangers and damages that are needless.

ONE TYPE OF STEWART SEWER ROD

All over the country there are cities and villages that have found STEWART sewer cleaning tools and equipment—STEWART experience in their manufacture and use—a simple economical solution to their sewer troubles.

Why not gain a like benefit for your community by restoring your sewers to their original usefulness?

For you there is special, proven STEWART equipment for each different kind of job, backed by nearly half a century of know-how in designing, manufacturing, and using it. At least find out how we can help you—Now.

HAVE YOU "WPA" SEWERS

If so, many of them are now old enough to need their first cleaning. Why not get off on the right foot by first consulting STEWART for full data and helpful suggestions?

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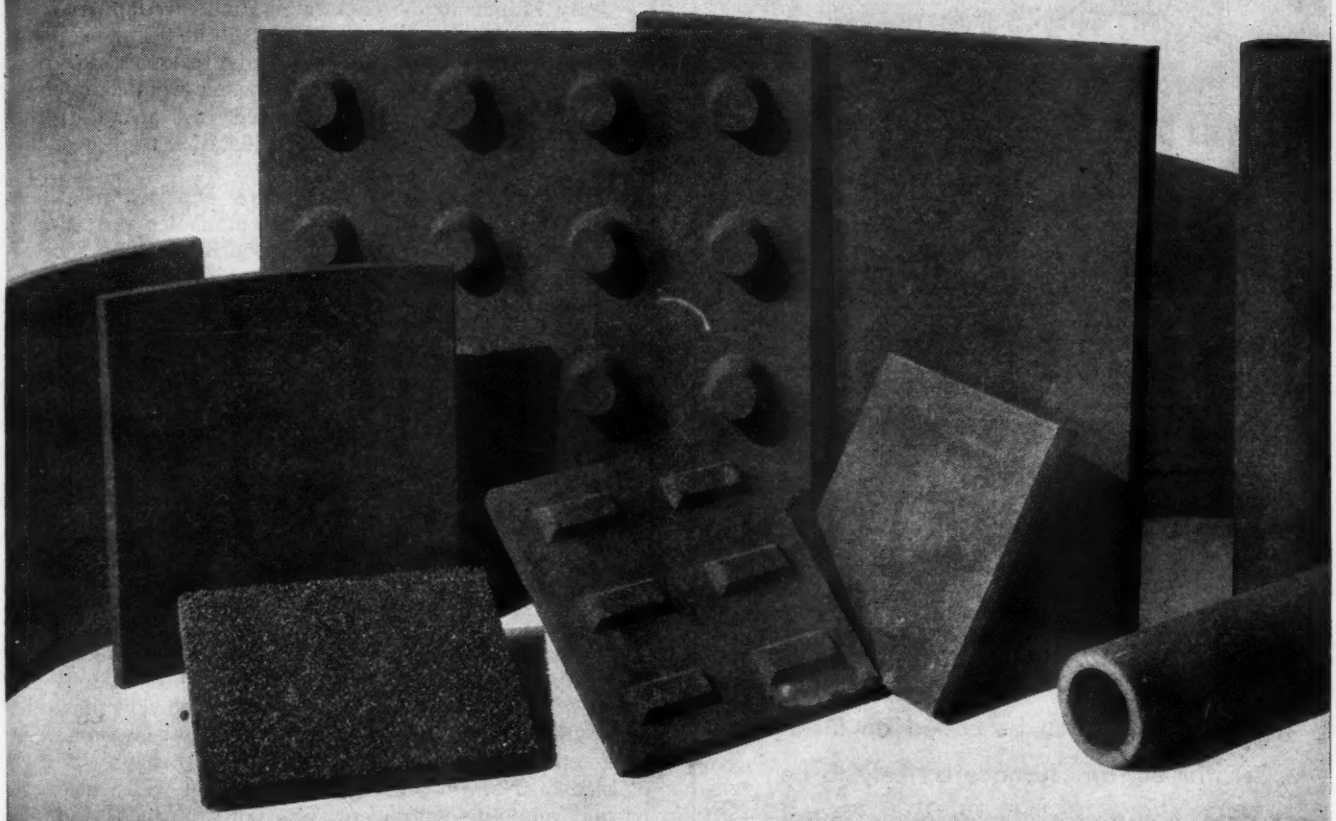

Public works planners who see beyond today are looking to Norton Porous Plates and Tubes as the modern medium for tomorrow's activated sludge sewage plants. For Norton Porous Mediums are the pioneers in the field of fused alumina diffusers. Norton engineers exercise the closest control over such essential qualities as permeability, porosity, pore size and wet pressure loss. The diffusion of air is the primary requirement of activated sludge sewage systems and Norton Porous Mediums perform this service with maximum efficiency and minimum operating costs over a long period of time.

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MORSE BOULGER
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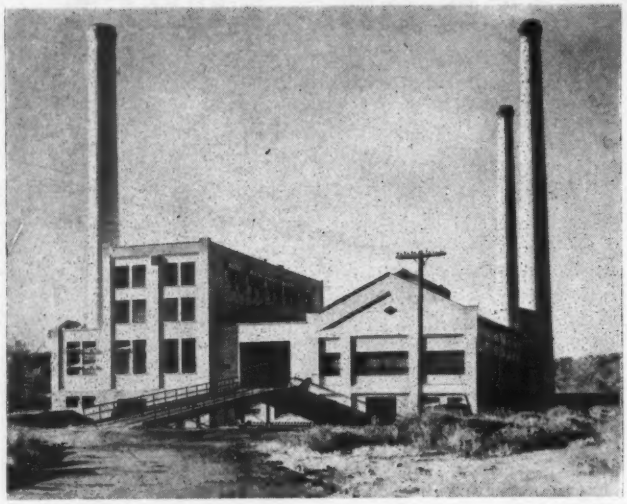

Incineration plant at New Rochelle, N. Y., where population increases necessitated two additions to the plant's original capacity. The Morse Boulger Destructor Co. handled the original plant and the additions.

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Any furnace can be called an incinerator but *any* furnace is likely to be only a furnace! Incineration is an engineering subject in itself . . . a subject in which Morse Boulger Engineers have specialized for years, paying particular attention to the destruction of municipal wastes.

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carried to completion, but cold weather suspended all other work until spring. On February 20, 1943, the gates of the Berlin dam were closed and the impounding of water began.

Meanwhile plans of Contract II were prepared, consisting of raising two buildings, constructing a regulating chamber, and building a new low-level pumping station at the edge of town to replace a station which would be flooded out during high lake levels. Bids were received on February 23 and the contract awarded to Albinson & Co., low bidder. Work on Contracts I and II proceeded simultaneously through 1943.

By March 20 the backwater from the dam, now at elevation 1,016, reached the plant and began backing up the outfall sewer. On June 1, the reservoir elevation was 1,030.3 and sewers and by-passes were completely filled. Manholes had been raised just ahead of the water, and tide gates had been installed to protect the various units of the plant.

Many anxious moments were experienced when several small leaks developed in manholes and sewers, and at one time water began pouring out of a catch basin which inadvertently had been missed in the sealing-off process. One evening an unsealed pipe poured a foot of water into the main pumping station, coming in over the switchboard and putting all pumps out of operation. All of this happened before the plant site was filled to an elevation above the reservoir. However, the work proceeded, and on July 8 the reservoir was completely filled to elevation 1,032. From that time on the reservoir was drawn upon to afford stream flow in the Mahoning river and the level gradually receded.

Buildings Raised

One of the chief projects of the second contract was the raising of the screen building and the main pumping station. The former was raised four feet. The pumping station superstructure was broken loose at the foundation and raised ten feet. New walls were poured and the ground filled to the new elevation. The accompanying photographs show how this job was carried out. The basement, including wet wells, heating, and pumping equipment, was not disturbed, and the station was kept in operation at all times. A new floor was constructed over the whole building at the new ground elevation, giving considerable extra space for workshops, locker and shower rooms, chlorine room, etc.

Control Chamber

Another feature of this contract was the regulating chamber constructed on the trunk sewer as it enters the plant. This chamber serves a dual purpose. First, by means of a Brown and Brown regulator the amount of flow entering the plant is controlled. Although the Alliance sewer system is built on the separate plan, considerable storm water reaches the plant, raising the normal flow of 2 mgd to a rate as high as 10 mgd after heavy storms. The State Department of Health has ruled that storm flow in excess of two and one-half times the dry-weather flow may be by-passed, so the regulator is set to by-pass all flows in excess of 5 mgd. The elevation of the weir of this chamber is 1,034 so that excess flow may be by-passed directly to the reservoir, even during periods of full reservoir.

The second feature of the chamber is a solenoid controlled, hydraulically operated valve, connected by means of a mercoid pressure switch to the wet well in the pumping station, and also connected to the power feed line, so that in the event of either a power failure or the raising of the sewage flow in the wet well to a predetermined height, the hydraulic valve will close, by-passing all sewage.

This feature was necessary since, at periods of high lake levels, failure of power or pumping equipment would in a very few minutes flood the lower parts of the plant with sewage.

Priorities

Complete priority assistance had been promised the city at the time the cash settlement was made; later, however, priority assistance was removed from the power of the U. S. Army Engineers and it was necessary to seek priorities at each step. This difficulty reached its height when the city was refused priority assistance in obtaining the rotary distributors for the trickling filters. Numerous conferences were held with the Army Engineers, State Department of Health, and the U. S. Public Health Service, reapplications were made but help was not forthcoming.

Until such distributors could be installed it was necessary to by-pass secondary treatment when the reservoir was above elevation 1,020, and to by-pass all treatment when above 1,030, the elevation of the top of the Imhoff tanks being 1,031. Tide gates were installed early in the construction to prevent water from backing into the by-passed units. During the summer of 1943 the entire plant was by-passed for a period of two months, and when the reservoir water receded below the plant, the possibility of creating a nuisance was present. When the reservoir dropped to a low of elevation 979, the main body of water being eight miles from the sewage treatment plant, sludge deposits were left near the outfall sewer.

Finally, with considerable help from F. H. Waring, Chief Engineer of the State Department of Health, W.P.B. was induced to review our application and on March 13, 1944, a priority rating was granted. Contract III for this installation was awarded on May 10, to the Tanner Construction Co. of Pittsburgh. To date all piping, conduits, etc., have been installed, but shipment has not yet been received on the distributors, which are being furnished by the American Well Works.

The maximum elevation of the reservoir this past summer was 1,028.8 on June 5, consequently it was necessary to by-pass all treatment this year.

Costs

This construction work was carried on during a period of rapidly rising prices, and it was difficult to estimate costs, especially of labor, from day to day. Lack of labor also caused considerable delay in the completion of the various contracts, Alliance being in a critical labor area. The cost of the first three contracts, including engineering, will approximate $250,000, leaving the balance of this fund for work to be done in the postwar period.

Post War

Only that part of the work which was vitally necessary for the protection and the functioning of the plant, was carried out at the present time. Anything further would have been in conflict with the war effort. However, the design of the last phase of the work has been carried on and is practically complete at this time.

Contract IV will include the following: Conversion of the present Imhoff tanks into mechanically cleaned primary settling tanks; the construction of separate sludge digesters with sludge pumping station; installation of a mechanical screen; and conversion of grit chambers for mechanical removal and washing. This final contract will also include road construction and landscaping. It is estimated that this work will cost $175,000, so that additional money will have to be provided by the city.

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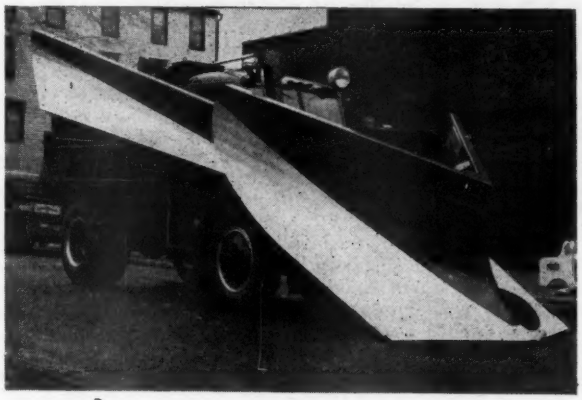
FOR STREETS, HIGHWAYS, AIRPORTS



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Adjusting Sewage Treatment to River Condition

(Continued from page 26)

satisfactory river conditions." The report of the Minneapolis-St. Paul Sanitary District for the year 1943, from which the above is quoted and which is the source of the information contained herein, devotes a chapter to its studies of the Mississippi river. These included the regular taking of samples at 24 stations along the river, from 21 miles above the sewage plant outlet to 72 miles below it, which covers the distance affected by the pollution from the Twin Cities in the past. Samples were normally collected twice a month at stations above the sewage plant, once or twice a week at those for 45 miles below the plant, and twice a month for the remaining 27 miles to and including Lake Pepin.

AVERAGE ANALYSES OF SAMPLES FROM 22 RIVER STATIONS

		Average Data for July, August and September, 1943			For January, February and March		
Station No.[1]	*General Location*	*Dissolved Oxygen ppm*	*5-Day B.O.D. ppm*	*Coliform Organisms M.P.N. per ml.*	*Dissolved Oxygen ppm*	*5-Day B.O.D. ppm*	*Coliform Organisms M.P.N. per ml.*
— 4.8	Entering Minneapolis	7.50	1.40	26	7.65	1.05	19
0.3	Wash. Ave. Br., ½ way through Mpls.	7.90	1.35	47	8.90	1.20	26
5.4	Lock & Dam No. 1, Mpls. & St. Paul	7.15	1.60	73	8.80	1.15	34
7.5	Ft. Snelling Br., just below Mpls.	7.55	1.80	130	9.50	1.25	47
9.1	Minnesota River at Mendota Br.	6.00	2.60	120	5.65	2.10	40
13.8	Robert St. Br., 2/3 way through St. Paul	6.70	2.40	200	8.55	1.55	130
16.6	Just above Twin City Sewage Plant	6.65	2.00	165	...	...	...
18.0	Just below Twin City Sewage Plant	5.60	6.35	15,500	8.45	9.85	3,350
22.7	Inver. Grove Br., below South St. Paul	5.30	4.05	11,000	7.95	7.75	2,750
26.5	10 miles below Twin City Sewage Plant	5.45	...	...	7.70	...	...
30.5	14 miles below Twin City Sewage Plant	4.85	3.75	11,500	6.70	4.75	705
33.9	Nininger	5.15	...	...	...	...	...
37.8	Just above Hastings Dam (Lock and Dam No. 2)	5.95	...	...	6.75	...	...
39.1	Hastings Highway Br., below dam	5.95	3.05	1,400	8.05	3.45	585
42.8	Below junction with St. Croix River	5.80	2.60	740	...	...	...
47.0	30 miles below Twin City Sewage Plant	5.95	...	...	...	...	...
50.9	Above Diamond Bluff	6.15	2.35	395	8.35	2.20	350
56.1	Just above Lock and Dam No. 3	6.15	2.40	365	8.50	2.05	245
61.2	Above Red Wing	6.60	2.70	485	8.30	2.25	300
74.0	Frontenac on Lake Pepin	6.65	2.50	23	7.55	1.75	72
80.2	Lake City on Lake Pepin	6.25	1.60	5	7.10	1.15	4
88.1	Outlet of Lake Pepin	6.25	1.40	1	6.75	1.05	1

[1] Indicates channel mileage from the head of navigation at the lower N. P. R. R. bridge in Minneapolis.

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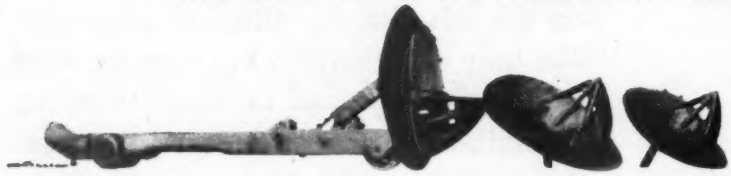

Model A-3 with 8"-10"-12" Shield

Sewage in the Line Furnishes the Propelling Power

Your sewerage system need not suffer from the manpower shortage. Your maintenance crew can restore all lines to full capacity with the use of this sanitary and economical method. It needs only a small crew to handle it and *reduces cleaning time 75% to 80%.*

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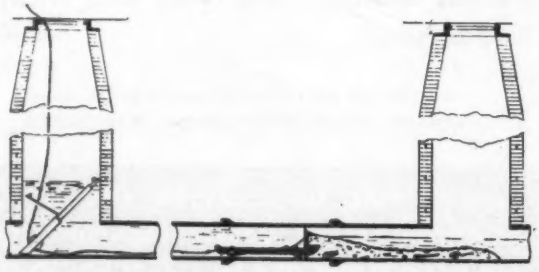

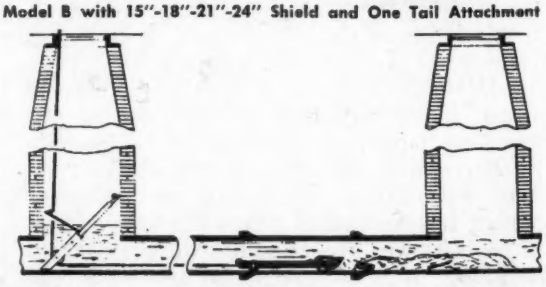

J. C. FITZGERALD, P. O. BOX 289, Coral Gables 34, Florida

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The river water samples were subjected to the following determinations: temperature, dissolved oxygen, pH, turbidity, one, five and ten-day bio-chemical oxygent demand, total bacterial count and coliform organisms. In addition to the analytical determinations, field observations were recorded on weather conditions at the time of sampling, existence of floating material or gassing, extent of ice coverage, algae, midge flies, and other conditions which might aid in interpreting the analytical data.

In general, the nuisance conditions which prevailed on the river (already referred to) before the sewage plant went into operation have now practically disappeared.

On the basis of many reports received, fishing in Lake Pepin and some parts of the river between the Twin Cities and Hastings has shown a decided recovery in the past several years.

Only occasionally, usually following heavy storms, can there be seen some debris floating on the water surface. The sewer systems of the Twin Cities are largely of the combined type for both storm water and sewage and must overflow to the river during heavy storms. It is for this reason that bacterial contamination of the water is still sufficiently heavy to render it unsafe for swimming a considerable portion of the time. Of course, even where separate storm sewers have been installed, they still bring into the river considerable debris which is washed off the streets.

Water Utilities and the Fair Labor Standards Act

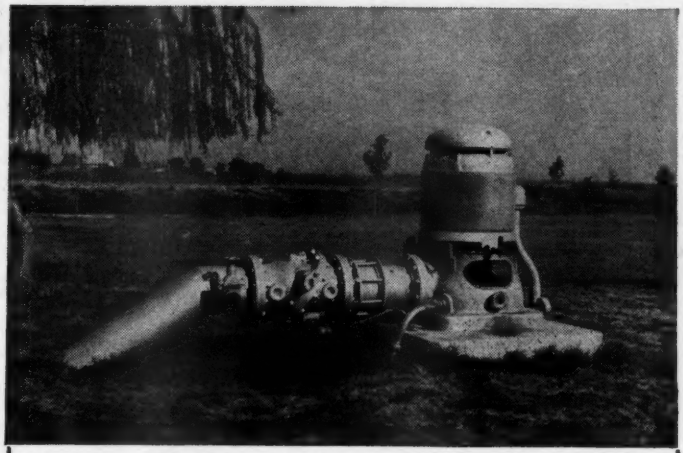
The employees of a water company engaged in installing and repairing mains, hydrants, meters and valves, inspecting plumbing, checking and testing the utility's distribution system, reading meters, collecting accounts, and in general clerical work and as janitors, were held to be too remote from the "production of goods for commerce" to be within the protection of the Fair Labor Standards Act, even if the company was engaged in interstate commerce. (Fountain v. St. Joseph Water Co., Missouri Supreme Court, 180 S. W. 2d 28.)

The court saw nothing in the Act to prevent the exemption as retailers from applying to a public utility which is a retail establishment. The defendant here is a public utility because it sells a commodity essential to modern municipal existence in which the public has an interest because it is vital to public health and safety, but it nevertheless sells it at retail.

Chlorinating Reservoir Because of Bird Contamination

The Lewiston, Idaho, water system includes five reservoirs with a combined capacity of 9,850,000 gallons. They are inspected daily for algae growth, and twice a year are drained, cleaned and disinfected and examined carefully for structural defects.

Last fall it was found that, in spite of this cleaning and sterilizing, coliforms appeared in the tap water. They were found to be due to bird contamination, and secondary chlorination of the reservoirs was tried as a remedy. An emergency chlorinator was installed on steps on the inside face of the reservoir embankment and a fire hose with nozzle was used for distributing the dose throughout the reservoir. A residual of 0.6 ppm of chlorine was sustained for 24 hrs. and this effectually eliminated the trouble.



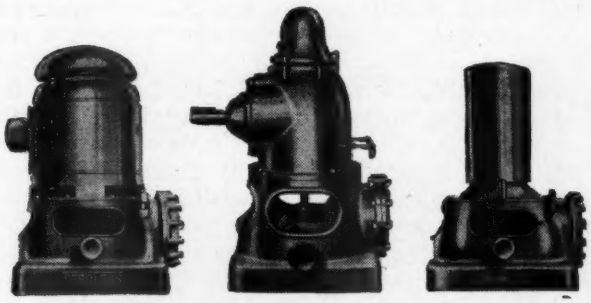
Peerless 60 H.P. Turbine Pump providing 1700 G.P.M.

Let's look ahead to your city's water needs

Engineers in city water departments are cognizant of the future needs of their city for water. In some places, lowering water levels require additional pumps or heavier duty pumps to offset the condition. Growing population or new building projects now and in the postwar period bring anticipation for new pumping equipment. Peerless engineers are closely working with city officials in countless communities checking needs for the future, making recommendations as to the type of pump best suited for each condition.

If you require a new pump (oil or water-lubricated) or would like to know more about how to step up your water supply, we will be glad to confer with you.

Capacities: 10 to 220,000 gallons per minute



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Pumping station and creek from which water was obtained.

An Emergency Water Supply Pumping Station

(Continued from page 19)

ferent type pumping units which could be spread all over the lot along the creek. The first thought had been to provide a double-end unit of the maximum H.P. required, coupling the auxiliary service pump on one end and the booster on the other, each as needed. Here the consultants did an admirable job by finding it possible to split the work, using two single stage units; the two in series for the auxiliary high head service, and either of the single units for boosting. It sounds simple, but as these units were finally specified not all manufacturers could meet requirements. This was because of the desire to have at least a 3 mgd capacity either boosting or from the auxiliary source; so pumps had to be found which would boost the gravity flow from 2 to 3 mgd singly, or when run in series deliver 3 mgd from the creek to the city filter — accepting whatever the delivery characteristics for such pumps might be against the highest head back to storage.

The desired pumps were furnished by Fairbanks, Morse & Co., as shown in the various figures and photos, and in addition some very desirable variations from the service originally planned. From Fig. 1 it will be seen that 3.5 mgd can be delivered direct to the city filter from the creek. This is using the two 100 H.P. units in series, with the line back to the storage reservoir at Churchtown closed. This condition would obtain only when something untoward happened to the supply main as stated in No. 3 (. . . that farmer and his dynamite!). When dry weather threatens, operation will be as shown at the 339 ft. head, 2 mgd nicely caring for the city and a solid 1 mgd filling up the storage. At any time the demand exceeds 2 mgd, with water in storage, it is simply a matter of using just one unit to boost at the capacity shown as 3.1 mgd. Even this is more than was demanded of the plant, but note the other possibilities. With water in storage, two pumps in series, and with the gravity supply flowing, 3.9 mgd is delivered to the filter, 0.5 mgd of which still comes by gravity to the station. Shown also is the theoretical capacity of the pumps in series, all flow toward Churchtown, which if actually tested would probably be a little more than the 2 mgd shown. However, there seems to be little or no need for this type of operation as the city will always take a substantial amount of the delivery.

Not shown upon Fig. 1 are two other methods of operation which are quite inefficient but nevertheless important under certain circumstances. The two units can be run in parallel or series under boosting conditions, delivering theoretically about 3.4 mgd at 92 H.P. each, and 3.6 mgd at 115 H.P. each respectively. There could be times during large fires, etc., when this slightly increased capacity would be very important and desirable regardless of efficiencies.

Probably there are some other methods of operation not thought of as yet; but enough—most of the fertile brains concerned are pump happy now. If the foregoing has befuddled the reader, there can be some consolation in knowing that even the consultant, about 2 o'clock on Test Day was heard to inquire, "And what are the little pumps doing now?"

Fig. 2 is schematic and shows the piping and valve arrangement, and the photos are self-explanatory.

All told, there are now seven different methods of operation and it is hard to believe that any other solution of the problem would do so much to safeguard the supply and augment the regular system. The cost, which was approximately $50,000, was less than half the estimated cost of any other remedial measures providing much less protection against failure of supply. Not the least important consideration is the low annual charges for interest, depreciation, and taxes. The operational charges are nil when the station is not in use, due to the outright purchase of the transformers which are physically cut off from the power supply during idle periods.

In all it is believed to be one of the most flexible of pumping applications—so much so, in fact, that officials responsible for its operation rather fear its whipping itself into a hydraulic knot they won't know how to untie. Right now it's idle and everyone hopes it remains so.

City's Water Company Selling Surplus Product to Other Towns Held Taxable in Maine

The rule of strict construction as to municipal grants of power has been modified in some recent cases in some jurisdictions, but only to the extent of holding that a municipal corporation, authorized by law to engage in the business of furnishing utility services to its inhabitants, may sell a surplus, necessarily acquired, to persons residing outside the municipality, but subject to the prior right of the inhabitants in case of shortage. In such cases it is frequently pointed out by the courts that, in so disposing of surplus electric current, the municipalities are acting in their proprietary or business capacities, and when so acting should have the same rights and be subject to the same liabilities as private corporations or individuals. (Greaves v. Houlton Water Co., Maine Supreme Judicial Court. 34 A. 2d 693, citing 38 Am. Jur., Municipal Corporations, §570, and cases cited.)

But in the present case the court saw no reason, under the circumstances of the case, why the Houlton Water Company should be exempt from taxation upon its property, used solely in the transmission and distribution of electricity outside the limits of the town of Houlton, which owned the company's capital stock. The company acted as a public municipal corporation as to Houlton but as a private enterprise in furnishing electric current to a dozen other towns. The company was held not exempt from taxation on its poles and transmission line in one of these towns.

Rats Spreading Typhus Fever

During September, 11 cases of typhus fever were reported in California, 8 in the southern part of the state having been contracted through the bites of infected rat fleas. The control of rats under war conditions is of particular importance, not only in the conservation of food supplies but also in the prevention of the more serious communicable diseases that are carried by rats and their fleas.

Anti-Pollution Decree Against Camden, N. J.

Chancery Court orders issued by Vice Chancellor Woodruff Thursday, October 19, 1944, enjoining Camden City from discharging raw sewage into the Delaware river strengthens the anti-pollution campaign to clean up New Jersey's waterways.

The final decree issued by Vice Chancellor Woodruff culminates extended efforts on the part of the State Department of Health to abate the emptying of raw sewage into the Cooper and Delaware rivers and their tributaries. The court directed the City of Camden shall complete plans and specifications for a comprehensive sewerage system and treatment plant, the plans to be approved by the State Department of Health by May 1, 1946.

Litigation against the City of Camden was initiated in December of 1941 by the Attorney General after surveys and gathering of evidence of alleged discharge of untreated sewage into the waterways.

A similar consent decree was recently obtained against Gloucester City, and the final decree against Camden disposes of State litigation against the last major discharger of raw sewage into the river.

The Chancery Court retains jurisdiction as to any additional time which may be allowed beyond May 1, 1946, for the construction of Camden's proposed sewerage system and treatment plant, dependent upon the availability of necessary materials and labor for general civilian public works.

War and Postwar Emergencies

(Continued from page 7)

and regional meetings of State highway departments with representatives of the Public Roads Administration. Limitation of the National system of interstate highways to 40,000 miles will permit inclusion of only the most important main highways.

The system of secondary or farm-to-market roads is to be selected by the State highway departments in cooperation with the county supervisors, county commissioners, or other appropriate local officials and the Commissioner of Public Roads. Carrying out the provision of the new Act will require a closer cooperation between State and county officials than has heretofore existed in many States, according to Commissioner MacDonald. Cooperation will also be required with various city agencies in constructing the express routes of the interstate system through cities.

In general, the Federal government will pay 50% of the cost, including surveys and preparation of plans, with an additional amount in public land states; also one third of the cost of right-of-way. Not more than 10% of any funds authorized may be used for grade crossing elimination, except for 50% payment for right-of-way.

The railroads must pay the United States for net benefits received from elimination of hazards at grade crossings, but such payment is limited to 10% of the cost.

The bill also provides for standardization of signs and markings.

Lewiston Removes Traffic Buttons

Traffic buttons in the middle of several streets in Lewiston, Idaho, have been removed because, the city engineer reported, "they were proven to be hard on tires and more of a hazard than a help. They were replaced by large yellow circles for traffic guidance."

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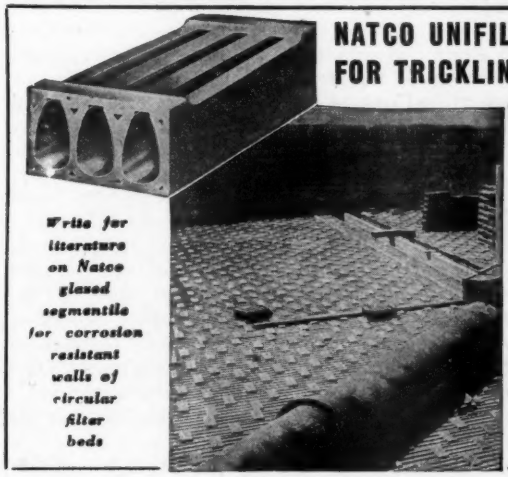

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The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Storing Raw Water for Des Moines

Des Moines, Ia., has a peak 24 hr. water demand of about 25 mgd. Water is obtained from an infiltration gallery in the coarse sand of the valley of the Raccoon river. Twice during the past 27 years the entire flow of the river has been less than the demand, causing a water shortage in the municipal supply. To prevent any repetition of this, a dam is being built 15 miles up stream from the collecting gallery, on a branch of the river, creating a reservoir which will be kept filled by pumping from the river when its flow is abundant; water from the reservoir to be released to flow back to the river by gravity when the river flow is inadequate. The reservoir will have a capacity of 4,800 acre-feet; sufficient, it is calculated, to carry the city through 100 days of maximum water demand under the most severe drought conditions. Its spillway, which is 102 ft. above the river, can be short because of the small watershed draining to it—1.4 sq. mi. Two 10 mgd electrically driven centrifugal pumps, located at the river 3,300 ft. from the reservoir, will fill it through 24" cast iron pipe, which will also carry the water returned to the river.[R2]

Effect of Heat On Meter Accuracy

Los Angeles has found that meters that tested satisfactorily at the factory with water at 40° to 45° F. did not do so when they used water at 62° to 65°, the discs expanding and binding in the measuring chamber. Also it was found that discs manufactured at different plant temperatures differed in diameter and so gave different efficiencies when assembled in meters.[F1]

Pumping for Variable Demands

The most common methods of providing for variable rates of consumption in a waterworks system are: 1—Elevated storage tanks. 2—Multiplicity of pumping units of different capacities. 3—Steam-turbine-driven units. 4—Throttling. 5—Variable-speed electric motors. 6—Constant speed electric motors with variable speed couplings. This article discusses the last three only.

When centrifugal pumps are operated at constant speed at or near constant discharge pressure for variable capacity demands, this is in effect throttling, whether or not the discharge valve is changed. Under these conditions a flat head pump characteristic is advantageous where slip losses are proportional to the reduction in speed.

Where only 5% to 10% speed reductions are required, the merits of the variable speed drive over the constant speed drive may not justify the former due to the greater initial cost. But where over 20% speed reduction is necesary for a good percentage of the time, there is no question of the economy of variable speed equipment. The wound rotor induction motor gives a very satisfactory variable speed drive for centrifugal pumps. It probably is the simplest of variable speed arrangements.

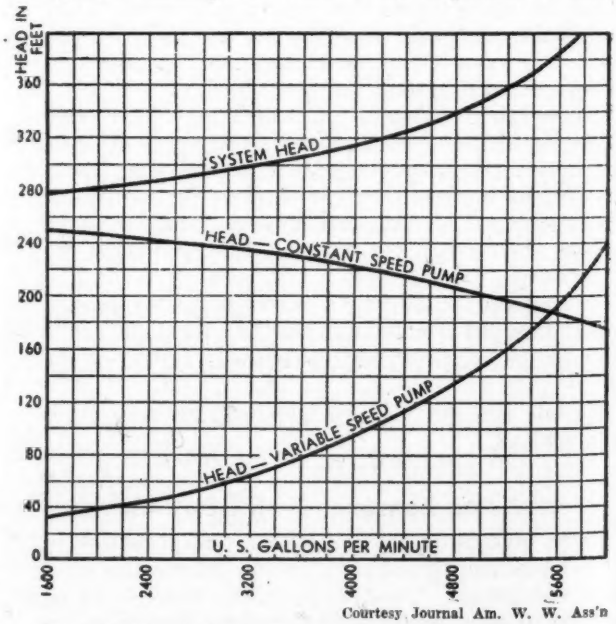
A magnetic coupling requires direct current for excitation, which would make it necessary to furnish a synchronous motor with an oversize exciter. Magnetic and hydraulic couplings offer infinite speed points for variable speed and are subject to the same performance factors as the wound rotor induction motor. The illustration shows the performance with a variable speed coupling connected between two series pumps, one of which operates at constant motor speed, the other at variable speed. The efficiency of this arrangement is practically the same as for a wound rotor induction motor.

Indications are that there may be new types of mechanical variable speed drives available for horsepowers of 5,000 b.h.p. in the near future and investigations indicate that the electronic motor, where the commutator and brushes are replaced by electronic tubes, holds promise for the future.[A4]

Meter Practices In Los Angeles

For the 4,170 irrigation services in Los Angeles, the water department uses velocity or current type meters, finding these to give maximum efficiency and low maintenance costs. Also the internal working parts can be moved from the main casing of a meter on a temporarily inactive service connection to the main casing of a meter on active service, as the rotation of crops and seasonal demands change, thereby keeping to a minimum the metering equipment necessary.

The department does not consider it necessary or economical to test meters after a standard interval of service, but only when the meter reading figures indicate sudden changes in consumption. Then a field inspection is made



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Head developed when one pump operates at constant speed and one at variable speed.

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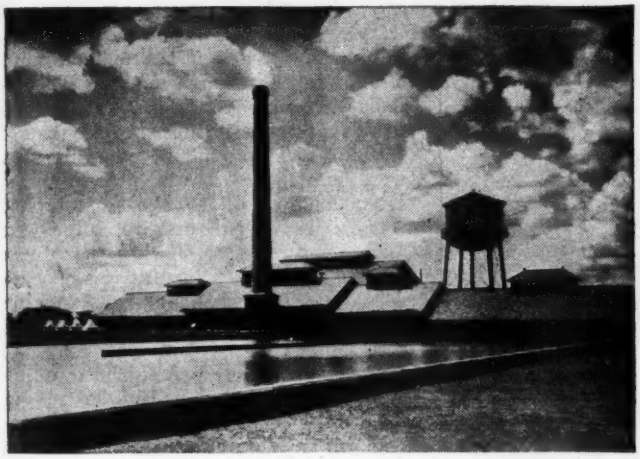

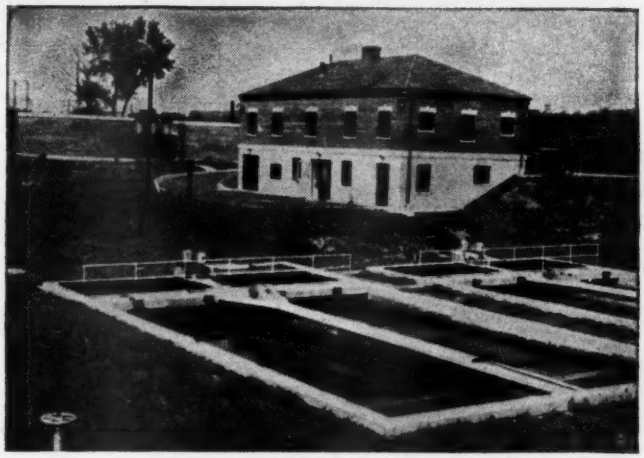

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by a meter inspector, who verifies the reading and inspects the register hands and gearing, change gears, and stuffing box spindle. If this indicates it to be desirable, the meter is replaced by another or is taken to the shop for test, and repairs if necessary.[F1]

Radio Allocations For Water Supplies

A formal request has been filed with the FCC for allocation of radio channels for water works use. Supporting this request were data from 60 of the 197 cities of 50,000 population or larger, showing that water utilities in 31 of these are now using radio, 26 are utilizing police fixed transmitters as primary transmitting stations, 15 are operating mobile transmitter units and 16 are operating mobile receivers only. Of the cities of over 50,000 population, 30% are utilizing police radio service. It was indicated that water utilities would use 1,100 to 1,200 transmitters under present regulations, or double that number if more liberal regulations be adopted which would enable essential operating communications to be handled by radio. At present radio communications are restricted to specified emergency situations.[A1]

Interconnections in New York and New Jersey

Since Pearl Harbor, water systems in Buffalo, N. Y., and neighboring communities have been interconnected chiefly because of inadequate capacities of the water supplies of the latter, furnished by the Western New York Water Co. and the Tonawanda and North Tonawanda system. Buffalo's rated capacity was 30 mgd above its demand, while the capacity of the Western New York Water Co. plant was 2 mgd below its average load. Nine interconnections were made between the systems of the company and that of Buffalo, each consisting of two hydrants, one on each system, connected by portable hose above ground. As the company's pressure is higher than that of Buffalo, 500 gpm mobile pumping units were located in convenient stations to act as boosters. Also two underground connections of 16″ cast-iron pipe were made; one of these serving the village of Kenmore, which in turn was connected to the Tonawanda system, and this to that of North Tonawanda. In 1943 the Tonawanda system was connected direct to Buffalo. FWA financed the entire program between Buffalo and its suburbs, which cost about $150,000, and title to the connections lies with that agency. Buffalo sells water to these suburbs at about twice the rates charged its own citizens.

In New Jersey, interconnections are centered about the metropolitan district across the Hudson river from New York, and about Camden. The former system of interconnections was recommended in 1940 by the State Water Policy Commission, but nothing was done until 1942, when construction was ordered by the state legislature. Thirty-three water departments and companies were included. The state paid all the cost of some, part of the cost of others, while some were paid for entirely by the owners, depending upon the benefits accruing. The program was completed by July, 1943, except for one emergency pumping station. Preference ratings were denied for two other pumping stations.

In the southern part of the state, interconnections were built between the Camden system and that of the New Jersey Water Co., the Merchantville-Pennsauken system, and the Gloucester system; also between the New Jersey Water Co. and the Borough of Haddonfield's systems; between Chester township and the Merchantville-Pennsauken and Moorestown systems; and between Gloucester and Mount Ephriam. An emergency Operation Center is maintained in the center of the Northeastern District, with a regular staff of three, one on duty at all times.[A2 and 3]

Development of Chlorine Treatment

Chlorine treatment of water has developed through three stages: 1st, up to 1940, control by maintenance of residu-

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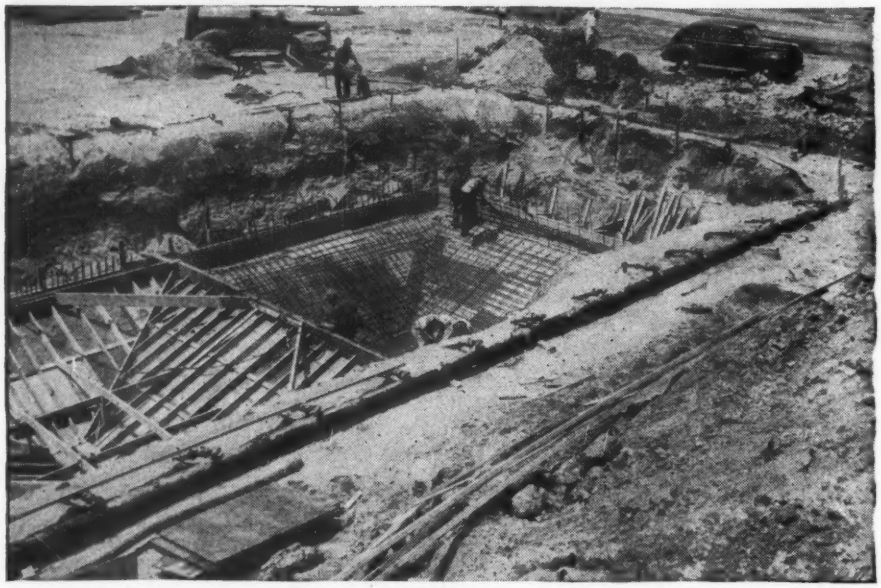

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als; 2nd, 1940 to late in 1943, transition from marginal to break-point; 3rd, development of the break-point flash test, when the flash color is 85% to 100% of that at the end of 5 minutes. Studies of the data concerning methods of treatment, results obtained and costs for 7½ years at four Indiana plants ranging from 0.5 to 4.0 mgd led to the conclusions presented. Benefits were measured principally by reduction in the percentage of 10 ml lactose broth tubes that showed the presence of non-confirming gas-producing organism in the finished water.

By use of the break-point flash test, the gas-producing organisms can be eliminated if the turbidity of the finished water is kept below 0.3 ppm. More chlorine will be needed and so the cost be increased, but it may be possible to offset this by differences in containers for the gas. If removal of tastes and odors is desired also, special effort should be made to maintain 100% *free* chlorine at all times. Use of the new flash control necessitates a revision of the concept relative to maintenance of chlorine residuals. The higher residuals obtained make essential the development of more sensitive color standards through the range from 1.0 to 3.0 ppm.[A7]

Control of Slime Growths in Mains

The author has been experimenting for 13 years in controlling slime growths and accompanying odors in the water of a southern California plant. The growths were caused by the presence of iron and sulfur and related organisms, and formed on walls of tanks and in pipe lines. They were controlled by chlorine in dosages of 5 to 15 ppm—much higher than needed to control pathogenic organisms. It was found that "control is only partly attained when the plant effluent is made sterile; it is equally important to clean up and maintain a distribution system free from iron and sulfur organisms, a system in which chlorine residuals will be carried to the remotest part." In controlling slime-forming organisms by true break-point chlorination, dechlorination is not always necessary.[A8]

Bacteria in a Distribution System

Since July, 1940, samples have been collected regularly from 6 dead-ends widely scattered in outlying sections of the distribution system and filter plant grounds and from locations of all complaints that the water was to blame for sickness, and these were examined for bacteria by standard methods and 495 different organisms isolated. Of these, 42 were Gram-positive coccus forms, 5 Gram-positive rods, and 448 were Gram-negative rods, 146 being members of the coliform group. During this time, treatment was changed from summer chlorination to all-year ammonia chlorination, with little effect on the counts. Temperature and disturbance in the mains, however, influenced the counts considerably. With the exception of a few strains of Alcaligenes, none of these organisms has been found in the chlorinated plant effluent nor in the dead-end in the filter plant grounds. Either they were present in the plant effluent and escaped detection by selective methods, or they were injured by the chemical treatment and recuperated when they reached favorable conditions, or the water became reinfected through new construction, main breaks, cross connections, etc. Evidence favors the last.[A9]

Bimonthly Meter Reading

Beginning July 1, 1943, the Los Angeles Dept. of Water and Power changed from monthly to bimonthly reading of domestic water and electric meters because of labor shortage. This reduced meter reading by about 37% and office work to a less degree. The saving in postage was $64,000 and 3,300,000 less envelopes were used. There are almost 900,000 active water and electric service accounts. The total saving in 12 months has been $365,000. The plan has proved entirely successful from both the customers' and the department's standpoint.[A11]

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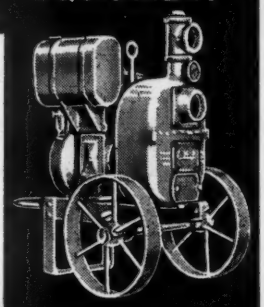

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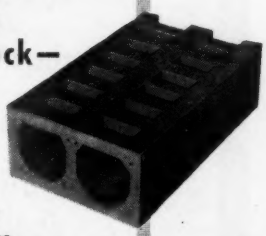

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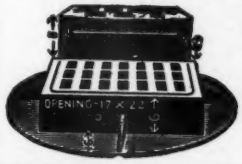

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After Germany Surrenders

Promptly after Germany surrenders WPB will relax markedly its controls over most materials in demand to meet needs of our civilian economy. The Controlled Materials Plan probably will be terminated within 90 days. Rated orders in effect at that time are likely to have a preferential position over subsequent unrated orders as to production. Therefore utilities should file applications promptly for priority ratings on projects. Except for lumber, most materials needed for waterworks construction are now available, but the manpower situation is tight. Over large areas of the country, special WPB committees must first approve the use of manpower on construction projects before priority ratings can be issued; but these restrictions may be relaxed after X-day.[B2]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

A *Journal, American Water Works Ass'n*

December

1. Application of the Public Water Supply Industry for Radio Channel Allocations. Pp. 1285-1293.
2. Constructing and Financing Inter-connections in New York. By Newell L. Nussbaumer. Pp. 1294-1300.
3. Constructing and Financing Inter-connections in New Jersey. By H. T. Critchlow. Pp. 1301-1314.
4. The Economics of Electrical Power Pumping. By C. A. Richardson. Pp. 1315-1322.
5. The Camp Robinson Water Supply Line. By W. L. Patterson. Pp. 1323-1327.
6. Chlorination Practices at Four Southern Indiana Water Purification Plants. By C. D. Adams. Pp. 1328-1342.
7. The Practical Use of the Ortho-tolidine-Arsenite Test for Residual Chlorine. By F. Wellington Gilcreas and F. J. Hallinan. Pp. 1343-1348.
8. Control of Iron and Sulfur Organisms by Super-Chlorination and Dechlorination. By Louis J. Alexander. Pp. 1349-1355.
9. The Bacteria in a Distribution System. By Albert M. Shannon and William M. Wallace. Pp. 1356-1364.
10. A Consolidated Colimeter for Streamlined Water Bacteriology. By A. Adler Hirsch. Pp. 1365-1370.
11. Benefits of Bi-monthly Meter Reading. Pp. 1371-1373.
12. What Kind of Public Works? By Henry B. Bleck. Pp. 1374-1378.

B *Journal, New England Water Works Ass'n*

September

1. Laws Governing Water Utilities. By David E. Moulton. Pp. 203-224.
2. Changing Trends and Their Effect on Water Utilities. By Arthur E. Gorman. Pp. 225-235.
3. Annuities for Public Service Employees. By F. J. Reny. Pp. 236-242.
4. Fall River Industrial Water Supply. By John L. Hayden. Pp. 243-254.
5. Water Purification Problems at Durham, N. H. By Kenneth E. Gunn. Pp. 255-257.
6. Chlorine Dioxide—A New Development in the Treatment or Potable Water. By John F. Synan, J. D. Macmahon, and G. P. Vincent. Pp. 264-269.
7. Water Disinfecting Tablets. By G. M. Fair, R. P. Burden, G. H. Conant and J. C. Morris. Pp. 270-277.

E *Egineering News-Record*

November 30

1. *p.* Public Health Service Water Standards. By J. K. Hoskins. Pp. 86-88.
2. Raw Water Storage for Des Moines. Pp. 91-93.

December 14

3. *p.* Elimination of Losses in Water Distribution Systems. P. 89.

F *Water Works Engineering*

November 29

1. Meter Standards and Practices at Los Angeles. By George C. Sopp. Pp. 1400-1402, 1429.

December 13

2. Meter Standards and Practices at Los Angeles. By George C. Sopp. Pp. 1452-1455.

J *American City*

December

1. Fall River, Mass., Supplies Water to Its Wartime Industries. By John L. Hayden. Pp. 64-55.
2. Wartime Water Works Remodeling for Permanence. By G. M. Ebaugh. Pp. 61-63, 117.

P *Public Works*

December

1. Controlling Distribution System Pressures by Means of Valve Control. By J. M. Lloyd. Pp. 13, 20.
2. Diatomaceous Earth Filters for Water Purification. Pp. 21-22, 49.
3. How Henderson, N. C., Maintained an Adequate Water Supply. By Henry T. Powell. Pp. 34, 38.

Six-cylinder sewage gas engine generating electricity at Ft. Dodge, Ia.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Sewage Treatment At Army Camps

It has been found in the Fifth Service Command (Indiana, Ohio, Kentucky and West Virginia) that trickling filters provide the most advantageous and economical secondary treatment because of their flexibility, low cost of operation and of maintenance, and simplicity of operation.

Grease in the sewage has been one of the major operation problems, averaging 75 to 300 ppm. Grease balls clog the nozzles of rotary distributors. At one plant, cakes of grease loosened from the sides of the sewers clogged the slots of the comminutor. At another, grease collected on top of a digester to 5 ft. depth and so tough a 6 ft. steel bar could not be forced through it.

Studies are being made to learn how to shut down various units of treatment plants as the loads are reduced by withdrawal of soldiers, and still maintain a good effluent. Operators who have operated army sewage treatment plants will prove very resourceful in handling municipal plants.[C3]

Disposal of Grease in Sewage

Grease in sewage materially lowers the efficiency of plants using biological methods. It coats stone in trickling filters, and lowers their efficiency, producing odors. In activated sludge plants the effect is still more marked. Saponifiable grease digests readily, non-saponifiable does not.

Grease can be removed more effectively near its source than at the plant; but the best grease traps do not remove more than 90%. The desirability of using traps in private residences is questionable; their cost and nuisance more than offset the advantages. It is hoped householders can be persuaded to continue wartime saving of fats for sale to salvage companies.

Many large disposal plants sell grease at a profit. New York City sells an average of 90,000 lb. of scum (37% grease) a month at 0.8¢ a pound. Chicago sells 5 tons per day of scum (35% saponifiable grease) at 0.6¢ a pound. Fort Dodge, Ia., at first rendered its skimmings and sold them at 7¢ per pound; now it sells the scum direct, receiving $4,834.04 from July, 1942, to April, 1944.

Other conclusions reached by the authors: Simpler and more reliable methods should be devised for making analyses for oils and greases. Plant operators should keep more complete records on quantities of grease and its removal in the plant. More data are needed on the efficiency of various devices for removing grease from sewage.[C1]

A study of decomposition of grease during digestion was made at the New Jersey Experiment Station, special attention being paid to the carbon-nitrogen ratios present in the fresh solids, since effective and normal sludge digestion is dependent rather definitely on this ratio. From this study the following conclusions were reached:

In general, the rate and degree of grease decomposition are greater than the destruction of other volatile matters in sludges. During digestion, a definite relationship between carbon and organic nitrogen is maintained. With the exception of activated sludge, grease reduction amounted to 70-80% and volatile matter reduction to 50-60%. Destruction of grease under anaerobic conditions appears dissimilar from decomposition under aerobic conditions. Limited amounts of grease, fats and oils do not affect the rate or degree of digestion The larger the quantities of animal fats present in sludge, the higher the gas production. The volume and character of gases produced change progressively with the increase in destruction of grease; the percentage of CO_2 in the gas decreases in relation to destruction of grease. The fuel value of sludges varies with the amount of grease present. Only a fraction of the total grease in fresh sewage solids consists of mineral oils. The relation between fuel values of sludge, grease and other volatile matter is indicated by the following average figures, showing the B.t.u. values per pound of dry material:

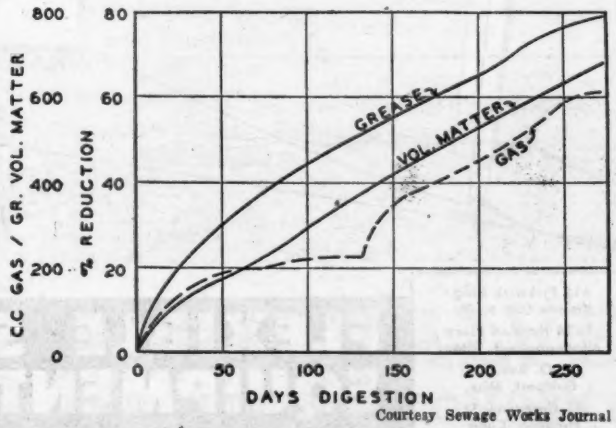
	Fresh Solids	*Ripe Sludge*
Total solids	9,110	5,385
Volatile matter	11,960	11,645
Extracted grease	17,135	17,710
Residue after extraction	5,905	3,000
Volatile matter of residue	8,880	7,050

Under ordinary conditions prevailing during digestion, non-saponifiable fats (mineral oils) are decomposed to a very limited degree.[C5]

Sludge Disposal At Cleveland, O.

At Cleveland's Southerly treatment plant, part of the digested sludge is dewatered on 8 glass-covered sand beds totaling 32,250 sq. ft.; clean washed sand from the grit chambers being used for replacement. Averaging the past eleven years, the number of fillings per bed per year was 12.2; 58.5 lb. of dry solids per sq. ft. of sand; moisture in sludge as applied to beds, 92.1%, in sludge removed, 63.1%.

More than 90% of the sludge is dewatered on 8 vacuum filters, each with 320 sq. ft. effective area. The cloth used is unbleached cotton drill, 68 threads per inch in the warp and 40 in the filter; 2.75 sq. yd. per pound. Its life varies from 162 to 239 hrs. Four-year averages are: 6.5% dry solids in wet sludge, 28% in filter cake. Chemicals used



Courtesy Sewage Works Journal

Relation between volatile matter and grease reduction and gas production.

averaged 14.2% lime, 12.5% CaO and 4.3% ferric chloride per lb. of dry solids.

Filtered sludge is incinerated in four incinerators, each of which has 8 hearths. Sewage gas is used for extra fuel. With 70.9% moisture in the applied filter cake, the per cent moisture on the first 5 hearths was 70.2, 67.1, 65.0, 33.7 and 21.0, respectively. On hearth No. 6 the cake burned rather vigorously. The temperature on the 8 hearths, respectively, were 500°, 680°, 740°, 1,000°, 1,250°, 1,310°, 1,220° and 920°. If the rate of feed is above the designed capacity, the moisture content of the cake on the various hearths will be greater, and the temperature less. The amount of extra fuel required varies inversely as the volatile content of the cake.[C2]

Effect of Changing Impermeability on Run-Off

In calculating run-off by the rational method, account should be taken of the permeability when the rain starts; the ground then may be dry and absorb a large part of the first rain fall, the impermeability factor gradually reaching its maximum as the rain continues. The author gives his reasons for concluding that:

1. In the case of areas with longer times of concentration the error arising through disregarding the possible change of impermeability is small.

2. In the case of areas with longer times of concentration the error arising through disregard or inaccurate use of the entrance allowance is small.

3. In the case of areas with shorter times of concentration the neglect of a possible change of impermeability and an inaccurate entrance allowance may lead to considerable errors in estimating the maximum rate of flow.

4. The maximum rate of run-off occurs at the end of the period of rainfall irrespective of whether the impermeable factor is constant or increasing in value.

5. If the impermeability of an area increases during rainfall then the maximum rate of run-off is less than that caused by an area whose impermeability remains constant at the maximum value unless the duration of the storm exceeds the "time of concentration."

6. If the impermeability of an area increases during rainfall, then the maximum rate of run-off is caused by some storm of longer duration and lesser intensity than that corresponding to the "time of concentration," and is usually caused by a storm of duration.

7. The total amount of rainfall required to bring a catchment area to its maximum state of impermeability increases as the intensity decreases, and is dependent in some degree upon the climatic conditions at the time.[D1]

Sewage Disposal At Folsom Prison

At California's State Prison at Folsom, sewage treatment conditions differ materially from those at municipal plants. Peak arrivals of suspended matters occur when all inmates wash for breakfast, and again in the evening, when they all throw matchsticks and cigarette stubs into the cell toilets. At nine P.M. the flow practically ceases. As the prison does laundry work for the armed forces nearby, there is a large amount of laundry waste. The prisoners send to the sewer large amounts of tobacco bags, wash rags, matchsticks by the thousand and torn-up letters. These difficulties are partially offset by the availability of plenty of labor.[H3]

New York's Postwar Sewerage Plans

New York State has deferred as much capital expenditure as possible to the postwar period and accumulated funds in the state treasury to permit postwar construction with funds already available and without increasing

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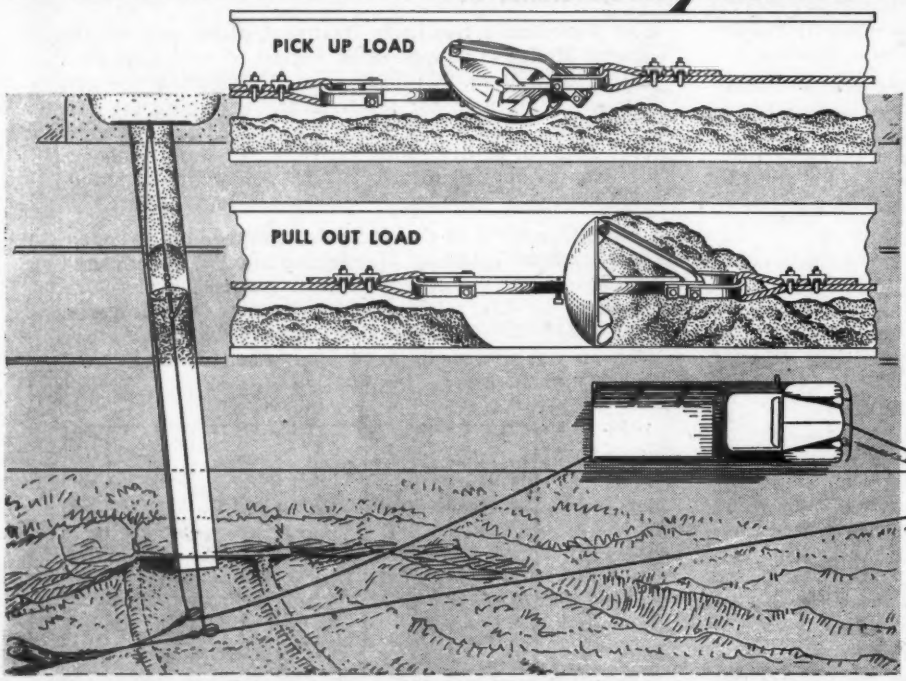

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taxes. The State Legislature has appropriated $7,500,000 for financing a Postwar Public Works Planning Commission, whose duties include coordinating postwar plans of various state agencies, allotting funds for preparing plans for state and municipal projects, defraying 50% of the cost of preparing municipal plans and estimates. Also it passed an act authorizing any municipal corporation, school district or district corporation to issue notes to cover the cost of preparing plans for postwar projects. The Planning Commission has received applications for 66 projects for sewage disposal and sanitation estimated to cost $33,612,675.[C7]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
November

1. Oils and Greases as They Affect Sewage Treatment Plants. By Frederick G. Nelson and W. N. Lauer. Pp. 1105-1111.
2. Sludge Disposal at Cleveland's Southerly Sewage Treatment Plant. By G. E. Flower. Pp. 1112-1114.
3. Experiences in Operation of Army Sewage Treatment Plants. By Arthur D. Caster. Pp. 1115-1119.
4. Gas Utilization and Installation of New Gas Engine Driven Pumping Unit at Muncie, Ind. By Paul R. White. Pp. 1120-1124.
5. Decomposition of Grease During Digestion, Its Effect on Gas Production and Fuel Value of Sludges. By Willem Rudolfs. Pp. 1125-1155.
6. The Toxicity Thresholds of Various Substances Found in Industrial Wastes as Determined by the Use of Daphnia Magna. By Bertil G. Anderson. Pp. 1156-1165.
7. Postwar Plans for Sewerage and Sewage Disposal Projects in New York State. By Earl Devendorf. Pp. 1166-1172.
8. The Need for Sewage Treatment in Florida. By J. B. Miller. Pp. 1173-1176.
9. The Industrial Waste Problem. By R. F. Goudey. Pp. 1177-1181.
10. The Responsibility of the Municipality in the Industrial Waste Problem. By Harold F. Gray. Pp. 1181-1188.
11. Some Examples of Liquid Industrial Wastes Treatment in California. By Edmund B. Besselievre. Pp. 1188-1192.
12. The Effect of Sewage Treatment on Maryland Streams. By Albert B. Kaltenbach and Abel Wolman. Pp. 1193-1215.
13. Sewer Maintenance and Control in Connection with Plant Operation. By Carl A. Wahlstrom. Pp. 1217-1220.
14. Gas Collection and Utilization. By Charles Gilman Hyde. Pp. 1221-1226.
15. Odor Control. By C. R. Compton. Pp. 1230-1234.
16. Interesting Extracts From Operation Reports. Pp. 1234-1250.

D *The Surveyor*
November 10

1. The Influence of a Changing Impermeability Factor on Surface Water Runoff. By W. H. Edgar. Pp. 543-544.
2. Sewage Disposal at Chichester. By F. R. Dinnis. P. 546.

H *Sewage Works Engineering*
December

1. Novel Design of Treatment Plant Blends With Neighborhood. By Charles P. Baulsir. Pp. 616-617, 645.
2. *p.* Boston Area Will Correct Pollution From 250 M.G.D. Pp. 622-623.
3. Treatment and Disposal of Prison Wastes. By Thomas M. Gwin. Pp. 624, 646.

J *American City*
December

1. *p.* Density Currents Make a Difference in Activated Sludge Settling Tanks. P. 64.
2. Wartime Sewage Problems Solved at Rollo, Mo. Pp. 68-69.

M *Water and Sewage*
November

1. *p.* Treatment of Industrial Wastes. By Geo. E. Symons. Pp. 42-45, 100.
2. *p.* Sanitation and Town Planning. By Jas. F. MacLaren. Pp. 46-48, 94.

P *Public Works*
December

1. Constructing Pasadena's Outfall Sewer. By J. H. Allin. Pp. 14-16.
2. Charges to Industries for Treating Their Wastes in a Municipal Plant. By Paul A. Uhlmann. Pp. 23-25.
3. Sewage Treatment Problems Require Thorough Investigations. By William S. Lozier. P. 26.

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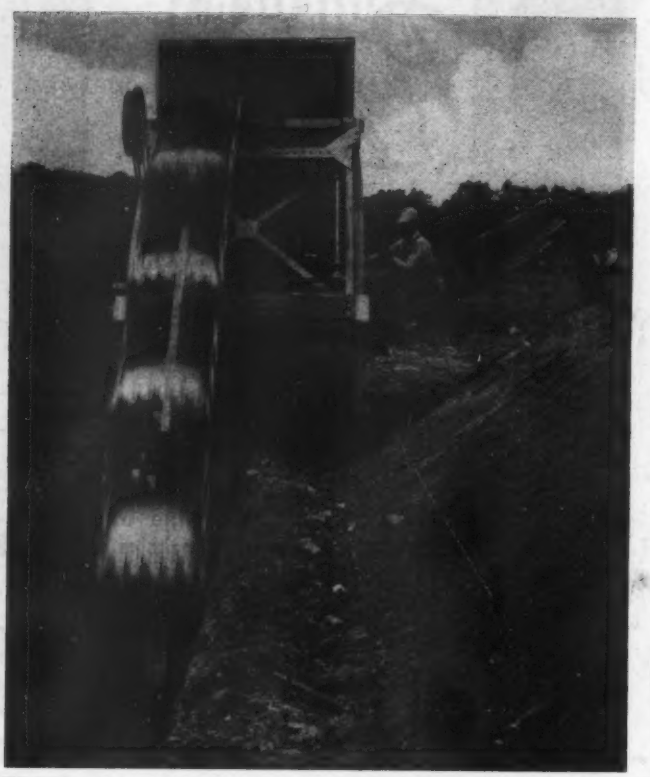

Parsons Trenchliner Model 250

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Two sets of speeds . . . five in each transmission . . . permit maximum operating speeds to suit the greatly varying digging conditions of trenching operation. Gears are enclosed, running in oil . . . cut from solid steel blanks, fitted on precision ground alloy steel shafts. Anti-friction bearings are used for mounting all the gear case shafts. Gear cases are dust tight. The five conveyor belt and bucket line speeds are synchronized and are independent of the five digging traction speeds.

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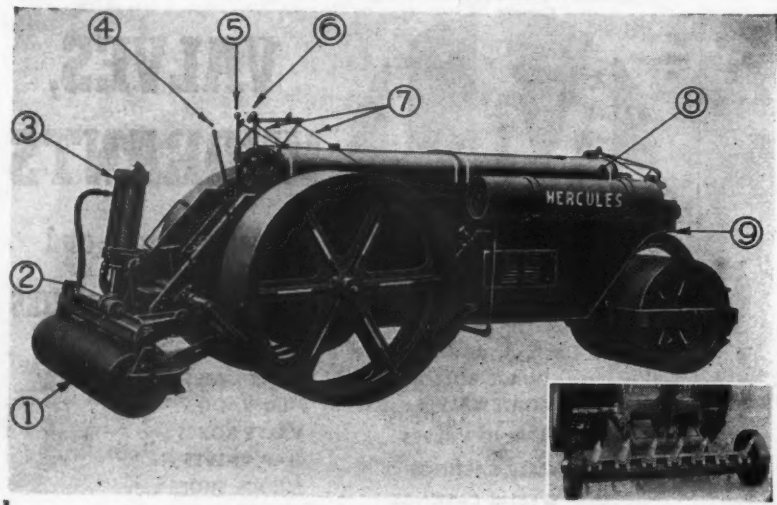

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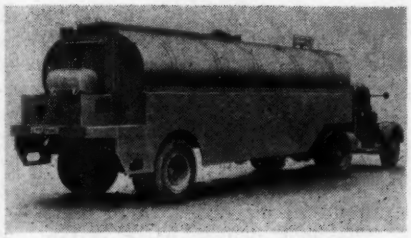

Littleford Bituminous Supply Truck.

Littleford "Frameless" Constructed Supply Tanks

Littleford Bros., Inc., Cincinnati, 2 Ohio have developed a new type of Bituminous Supply Tank that eliminates the use of a Trailer Frame.

This Supply Tank has a self-supporting tank and is made in semi-trailer models. "Frameless" Construction gives better load distribution and lower center of gravity. Made in sizes ranging from 1250 gal. to 4000 gal.

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Seep-Seal for Leaks in Concrete

A new material prepared especially to stop water leaks through concrete has recently been announced by the manufacturers of building maintenance materials. It is sold under the trade name Seep-Seal.

It is claimed that Seep-Seal mixed with cement, can be inserted in cracks or holes in concrete while water is actually gushing through, and that it will stop the leak in 2 minutes. Subways, reservoirs, foundations and other underground concrete structures can be kept virtually leak-free with Seep-Seal, according to the manufacturer.

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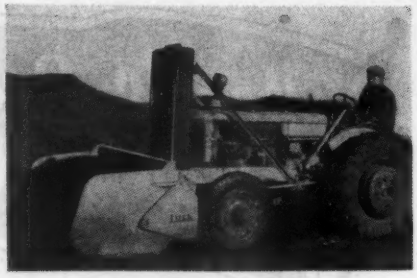


Model 4-D Lull Loader with snow bucket handling coal.

The Loader frame supporting the yoke, carriage and attachments and connecting them to the tractor, is of rugged construction. The tower yoke telescopes to a low overall height when in its lowered position. When it is raised and lowered, it travels on machined rollers eliminating excessive friction and wear.

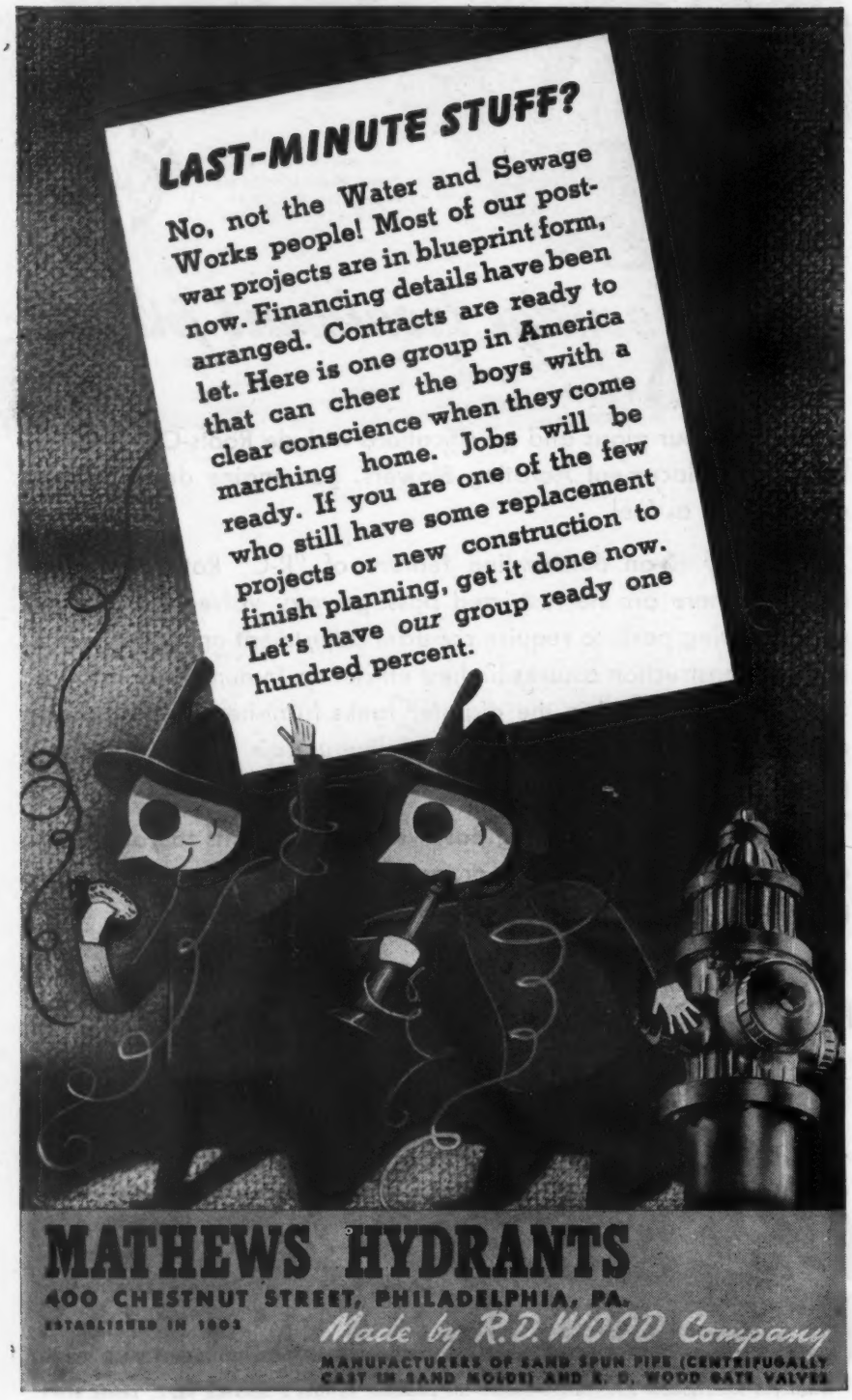
Among the numerous uses claimed by the manufacturers are: loading sand and gravel, cinders, snow, black top, or any materials that can be scooped up. Other attachments convert the loader into a lifter, a snow plow, or a bulldozer. Write for a folder fully describing all the mechanism of this versatile and useful tractor attachment.

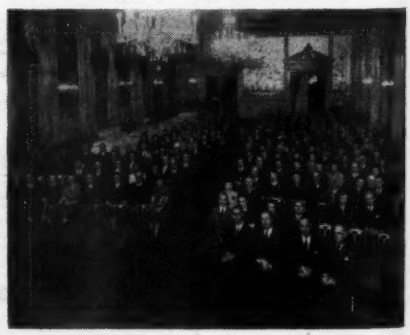
Air-Entraining Cement

The development of air-entraining cement, described as one of the most significant advances in cement and concrete in recent years, is outlined in a booklet published by the Universal Atlas Cement Company, entitled "Atlas Duraplastic—a new cement which makes concrete more durable and more plastic." It reveals the nature and shows the characteristics of air-entraining cement, as originated and developed by the company, with illustrations giving examples of the variety of its uses.

The book defines Atlas Duraplastic as a true portland cement in which there has been interground during manufacture a small but very precise amount of air-entraining material needed for satisfactory field performance. It complies with Federal and ASTM specifications and sells at the same price as normal cement.

Copies of the booklet describing this new cement and its use in concrete are available upon request to Universal Atlas Cement Company, Chrysler Bldg. New York.





%Proportioneers% employees see Diatomaceous Earth Filter Pictures.

%Proportioneers% Presents New Diatomaceous Earth Filter

A motion picture preview of the new %Proportioneers% Diatomaceous Earth Filter was the highlight of a recent meeting held by the Company in the ballroom of the Narragansett Hotel, Providence, R. I. Over 250 guests and employees saw color pictures of the Company's new filter in opreation. Among those present were officers and men of the U. S. Navy with whose cooperation the new filter was developed. The film demonstarted the simplicity and effectiveness of the filter un-

der actual operating conditions; water from a stagnant pond was sterilized in a %Proportioneers% Pur-O-Pumper and then passed through the new filter which produced perfectly clear, potable water quickly and in large quantities. The diatomaceous earth filter was shown as of particular importance for portable equipment where its compactness, light weight and exceptional purifying powers offer many advantages over ordinary sand filters. After the showing of the film, a buffet supper was served.

Water and Sewage Works Manufacturers Assn. Elects New President and Vice President

The Board of Governors, at a meeting held on November 29,1944, elected former Vice President Everett M. Jones to the Presidency and Theodore V. Wood as Vice President.

Mr. Jones is General Manager of Simplex Valve & Meter Co., 68th & Upland Street, Philadelphia 42, Penna., and Mr. Wood is Sales Manager of the Pipe Department of the R. D. Wood Company, 400 Chestnut Street, Philadelphia 5, Penna.

New Thornton Locking Differential Literature

A brochure entitled, "The Sensational War Tested Differential for Trucks . . . Stop Wheel Spin," illustrates installation, shows the application and explains the benefits derived from installation of the Thornton Locking Differential. Copies available upon request to Mr. S. F. Baker, Vice President, Thornton Tandem Company, 3701 Grinnell Avenue, Detroit 13, Mich.

Improved Lighting of Buffalo Streets Among First Post-War Projects

Because far too many night traffic accidents of all types have been occurring on Buffalo, N. Y. streets, street lighting has been placed high on that city's priority list of post-war projects. An analysis covering five years, made by the Board of Safety's Accident Committee in co-operation with the Police Department, has revealed that in nearly all night accidents involving motorist and pedestrian the driver did not see the pedestrian at all or until it was too late to avoid the accident.

Spot maps of the city indicating the locations of fatal accidents for the five-year period show that 227, or seventy-seven per cent of all night traffic deaths occurred on seventy-two miles, or ten per cent of the city's streets. Street lighting evaluator and other illumination tests, made in co-operation with General Electric engineers further indicate that present lighting on these streets is good only for light traffic.

Present plans are to modernize at

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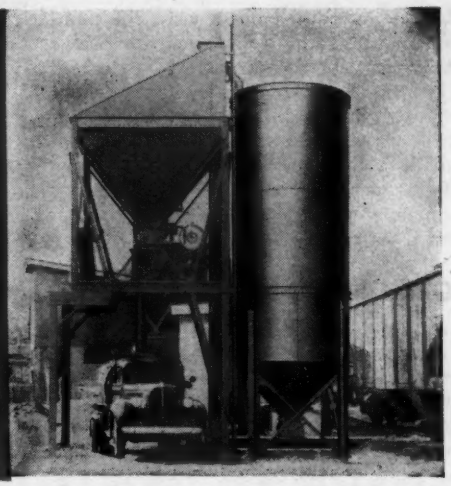
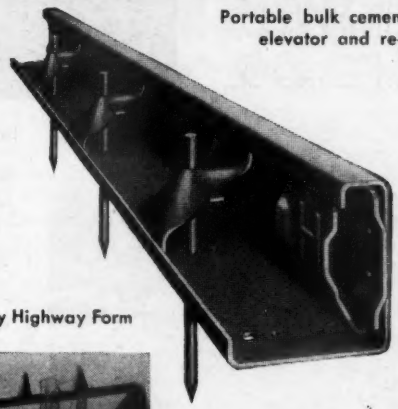
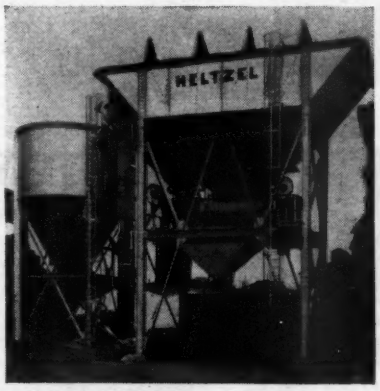


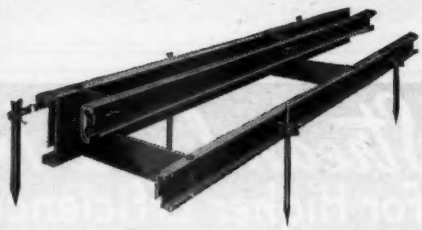
Portable bulk cement plant with built-in elevator and re-circulating tank



The new Heltzel Military Highway Form



A typical Heltzel Truck Mixer Charger—600 ton Batching Bin—1200 bbl. Bulk Cement Reserve



Steel Curb and Gutter Forms for any cross section on specification

Portable aggregate Batching Bins made by Heltzel in capacities ranging from 30 to 200 tons.

BINS Portable and Stationary
CEMENT BINS Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with lip curb and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
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SEWER AND TUNNEL FORMS
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SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO • U. S. A.

the rate of 1000 poles a year, the number required for approximately twelve miles of new lighting. It is estimated that this improvement in main traffic street lighting will save at least thirty-three lives, more than a thousand injuries and nearly five thousand cases of property damage — representing economic yearly savings of a million and a half dollars.

Good News at Water Works Convention

Even tried and tested water men can smile these days, as witness the above group of delegates to the recent 25th Annual session of the South Western Section of the American Water Works Association held in Los Angeles. Looks like Fred J. Cook, Pacific Coast manager of the Robt. W. Hunt Company has received some good news, also enjoyed by (left to right) Clarence M. Rainey, Supt. of Water Works, Pocatello, Idaho; Fred Klaus, city engineer of the City Water Dept., Sacramento, and Fred Webster, meter engineer of Pittsburgh Equitable Meter Company, San Francisco office.

Left: Davey Compressor Crash truck. **Above: Good news at convention.**

A Portable Fire Extinguisher for Airports

Whether they are equipped to discharge carbon dioxide, a solid water stream, foam, or the most recently developed quencher technique of high pressure fog—the extinguishing agent depending on the type of fire—crash trucks all possess the factors of speed, high mobility over almost any terrain,

Streamlined Inside
for Higher Efficiency and Lower Operating Costs

RUGGED SIMPLICITY OF DESIGN ELIMINATES RECIRCULATION —

NEVER LOSES PRIME REQUIRES LITTLE ATTENTION

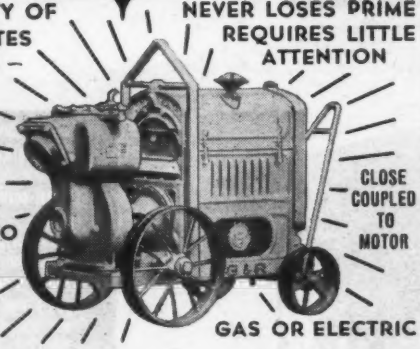
DELIVERS GREATER VOLUME PER GAL. OF GAS

NO ORIFICE OR PRIMING VALVES TO CLOG OR JAM

CLOSE COUPLED TO MOTOR

CAPACITIES UP TO 125,000 GPH

GAS OR ELECTRIC



Streamlined where it counts, you can't clog a Gorman-Rupp Self-Priming Pump. Unequaled in rugged efficiency, gallonage or continuous hours. A size and type for every need.

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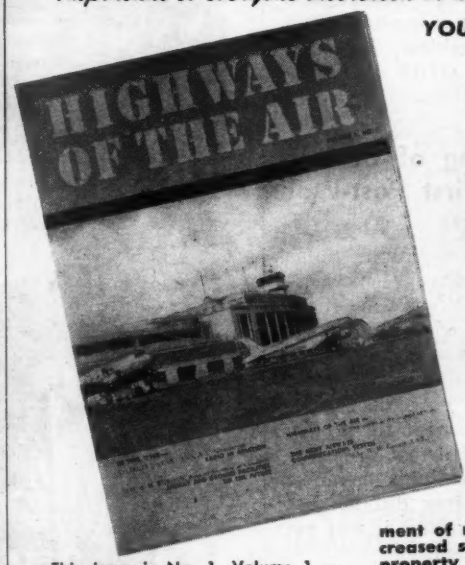
GORMAN-RUPP
SELF-PRIMING CENTRIFUGAL PUMPS

"HIGHWAYS OF THE AIR"

Important to everyone interested in airports and aviation



YOU SHOULD KNOW —

What is the "bottleneck" in post-war expansion of civil aviation . . . . See page 8

Why CAA is installing Ultra High Frequency radio ranges. See page 8

What anti-collision devices are being developed . . . . See page 9

What electronic aircraft detectors are. See page 9

What can civil aviation learn from the A.A.C.S. See page 2

What goes into an instrument landing system . . . . . See page 11

What is approach control . . . . . See page 11

These questions and dozens of others of vital import to all those interested in the development of radio in aviation for increased safety of human life and property are discussed in the pages of "HIGHWAYS OF THE AIR"

This issue is No. 1, Volume 1 — others will follow if you request them. Contents are authoritative—but non-technical—designed to inform the layman on a subject which is becoming of increasing importance.

Send for your copy on your letterhead—we are glad to send it as our contribution to a greater Air-America. Address Desk P.W.-11.

Radio Receptor Company, Inc.
251 West 19th Street New York 11, N. Y.
Engineers and Manufacturers of Airway and Airport Radio Equipment
Radio Navigation Aids • Airport Traffic Controls
SINCE 1922 IN RADIO AND ELECTRONICS

When you need special information—consult the classified READER'S SERVICE DEPT., pages 67-69

and the ability to push in close to the plane and attack the source of the flames.

The manufacturer says Crash Trucks drive right up to the blazing plane, with their nozzles belching a smothering spray at high pressure of 600 to 800 lbs., and virtually blast a path through the flames, providing firemen and victims with a cooling waterfog blanket. In a matter of seconds, lives have been saved and a withering inferno extinguished.

The illustration shows an Army crash truck, equipped with the Davey Truck Power Take-Off, extinguishing a trainer plane blaze.

Besides satisfying Army requirements for crash trucks, the Davey Heavy-Duty Truck Power Take-Off is designed to handle power transmission from truck engine to auxiliary equipment in nearly all truck models of 1-½ ton or more capacity, with wheel bases of at least 117" for cab-over-engine types and 134" for conventional cab types.

Davey Compressor Company, Kent, Ohio, will gladly supply Power Take-Off literature you request.

A New Roots-Connersville Catalogue

Roots-Connersville Blower Corp. of Connersville, Ind., has issued a new four-page general bulletin, No. G-81-D, covering its Rotary Positive Blowers and Gas Pumps, Centrifugal Blowers and Exhausters, Rotary Positive Vacuum and liquid Pumps, Rotary Displacement Gas and Liquid Meters, and Inert Gas Generators.

This folder is profusely illustrated. Typical installation views are shown covering the principal applications of Roots-Connersville equipment, such as the water works and sewage treatment plants, supercharging and scavenging Diesel engines.

As recently announced, Roots-Connersville Blower Corp. became "one of the Dresser Industries" on Nov. 1st. Two plants are operated in Connersville, and sales offices are maintained in New York, Chicago, Pottstown, Pa., Boston, Pittsburgh, Detroit, St. Louis, San Francisco, and other principal cities.

Copies of the new bulletin are available on request to the main office.

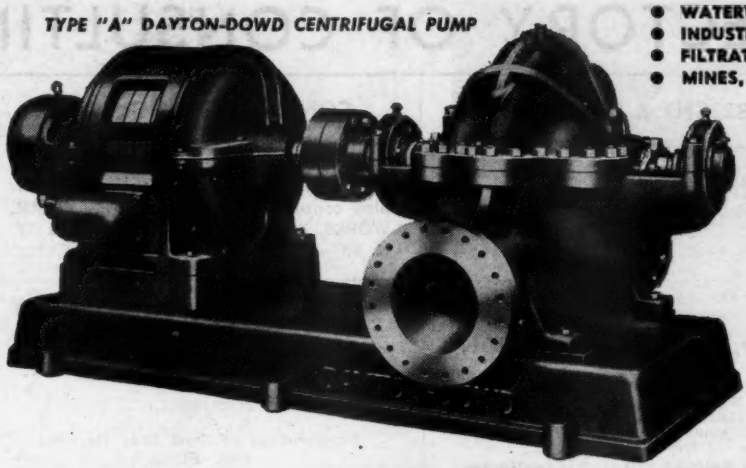
A Packaged Runway Brightness Selector

At a modern airport an airplane lands on a runway outlined on each side by rows of lights protruding only two or three inches above the surface and called contact lights. The lights must be visible but not be so bright as to blind the pilot. Hence different brightnesses are required for dusk, dark night, and low-visibility conditions. Controls for the lamps provide five degrees of light intensity; 100,30,10,3 and 1 per cent of

(Continued on page 65)

TYPE "A" DAYTON-DOWD CENTRIFUGAL PUMP

- WATERWORKS
- INDUSTRIAL PLANTS
- FILTRATION PLANTS
- MINES, ETC.



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PUMPING SERVICE

TYPES — Single stage, single suction, sizes 2" and 3". Single stage, double suction, sizes 2½" to 42". Capacities up to 60,000 G.P.M.

SPLIT CASE DESIGN — For easy accessibility. Available in either cast iron, chrome iron, cast steel, bronze, monel and other alloys.

IMPELLER — High efficiency design. Made of cast bronze. Also available in KA-2 stainless steel, cast carbon steel monel or other alloys.

DRIVE UNITS — Pumps can be supplied with dual drive hookup. Electric motor and steam turbine. Electric motor with gas engine. Twin pumps also available with one electric motor.

FREE CATALOG. Write on your business letterhead for interesting FREE catalog. Address: DAYTON-DOWD Company, Dept. P-13, Quincy, Illinois.

DAYTON-DOWD

Turbine Pumps • Centrifugal Pumps

STANDARDIZE?

By All Means!

No experienced waterworks executive would consider changing makes if *thoroughly* satisfied. Nor would any sensible manufacturer *suggest* doing so.

But many cities call for bids on all requirements and buy on price alone (there is seldom very much difference in price among standard Valves and Hydrants). This results in a hodge-podge of various makes which will be a *continual nuisance* to the waterworks executive—and more expensive to the city, in the long run.

So if you are 100% satisfied with the make representing a majority, by all means *STANDARDIZE*—and earn the blessings of future generations (good equipment will still faithfully be serving your great, great, grandchildren).

RENSSELAER VALVE CO., TROY, N. Y.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 67-69*

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Preparation of Post War Reports and Plans

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Sewerage, Sewage Disposal
Water Supply and Treatment
Garbage, Refuse, Industrial Wastes
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Broad St. Station Bldg. Philadelphia

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Established 1913

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MUNICIPAL PUBLIC WORKS ADMINISTRATION

This course given by correspondence is designed to acquaint public works directors and city engineers with the organization and management of their departments. Personnel, planning, equipment, measurement, records, reports, and public relations are emphasized.

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1313 EAST 60th STREET, CHICAGO, 37

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 67-69*

CONSULTING ENGINEERS

(Continued from page 64)

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Airports-Drainage
Electric Power—Waterworks
Sewerage—Valuations—Rate Studies
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Central State Bank Bldg. Muscatine, Ia.

(Continued from page 63)

full brightness. In the past the assemblage relays, cutouts, and other switching equipment required to select the desired brightness for the particular one of several runways was quite imposing. For a large airport the switchboard looked like it might be for a sizable power plant. Now all this contact-light selector equipment for four runways is embodied in the constant-current transformer and in a single selector cabinet —occupying a space of five feet by two feet and four feet high.

Write Westinghouse Electric & Mfg. Co., P. O. Box 1017, Pittsburgh, Pa. for full description.

CONVENTIONS

January 16-19, 1945 . . . The 42nd Annual Meeting of the American Road Builders' Association, Stevens Hotel, Chicago. Plans for launching the greatest highway program in history will be considered from every angle.

January 17-18 . . . Sanitary Engineering Division of A. S. C. E., Engineering Societies Bldg., 33 W. 39th St., New York.

January 19 . . . Seventeenth Annual Meeting of N. Y. State Sewage Works Assn., Hotel Pennsylvania, New York.

February 21-22 . . . Southeastern Association of State Highway Officials, Thomas Jefferson Hotel, Birmingham, Ala.

February 8 . . . Winter meeting of N. J. Section, American Water Works Assn., Winfield Scott Hotel, Elizabeth, N. J.

Cash Acme 1945 Catalog Ready

The A. W. Cash Valve Manufacturing Company, Decatur, Ill., has issued a new 28-page descriptive catalog. It features detailed information and specific data on the complete line of Cash-Acme Automatic Valves and Pressure Controls for use with water. Production facilities are geared to make prompt shipment of the Cash-Acme Valves and Pressure Controls.

Copies of the catalog are available upon request.

Aeroil Wins Army-Navy "E" Award

As a reward for their outstanding record in the production of war equipment, Robert F. Patterson, Under Secretary of War, has announced the award of the Army-Navy "E" to Plant No. 1 of the Aeroil Burner Company, Inc., West New York, N. J.

"This award is your Nation's tribute to your patriotism and to your great work in backing up our soldiers on the fighting fronts" wrote Mr. Patterson in a letter to George P. Kittel, presi-

Known Around the World as the Sign of Exellence in Water Treatment Equipment

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

Gravity Filters
Softening Plants and Equipment
Pressure Filters
Zeolite Softeners
Swimming Pool Recirculating Apparatus
Special Water Treatment Equipment

We invite your inquiries
ROBERTS FILTER MFG. CO.
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AERO-FILTERS
PROVIDE THE
LOWEST OVERALL COST
of any type of trickling filter since they produce results by low momentary rainlike distribution without heavy recirculation. Pumps, clarifiers, interconnecting piping, and filter underdrains are not enlarged for heavy recirculation. See bulletin 112.

Get greatly increased primary clarifier efficiency through the use of the Spiraflo clarifier. See bulletin 120.

Bulletin 36 gives full details of Lakeside's zeolite water treating plants.

WRITE US FOR THESE BULLETINS
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dent and founder of the company in the official notification by the War Department.

While the award to the Aeroil Burner Company was based on their manufacture of equipment that is used directly in the war effort, the management has been gratified by the fact that a great proportion of the "Heet-Master" Kettle production, too, has been earmarked for use by the Armed Forces since the beginning of the war.

Volclay for Clarifying Water Is Described in a 4 Page Folder

The manufacturers say Volclay Bentonite is a natural mineral colloid which swells greatly in water forming flocs that enmesh the suspended impurities and in settling drags them down, clearing the water. It is effective from 2 to 12 p H. It is also claimed that Volclay stops leaks in dams, reservoirs, concrete pools, etc.

When wet it becomes a putty like mass through which no water can pass. Write American Colloid Co., 363 W. Superior St., Chicago for full information.

New Test for Cutback Asphalts

An interesting new test for cutback asphaltic mixes is suggested in recent work by A. W. Dow, Inc., of New York. A conventional stripping test followed by a Hubbard field stability test of the same sample is advocated as closely paralleling the field conditions that the mix must withstand.

The results and a detailed description of the test are published in a leaflet by Kotal Company, of 52 Vanderbilt Avenue, New York 17, N. Y.

Yale University Changes Bureau for Street Traffic Research to Bureau of Highway Traffic

The broadened meaning of the new name more nearly defines the scope of operation of this organization because it is not restricted to "research" alone or to the field of "street" traffic alone. The term "highway" is employed in its broader meaning to include traffic, whether on city streets or rural roads. The scope of future work of the Bureau of Highway Traffic accordingly includes training and studies in highway traffic matters pertaining to rural as well as urban areas.

"Bond-O," a New Sulphur Cement Jointing Compound

In a 14 page folder, Northrop & Co., Inc., 50 Church St., New York, N. Y., describes "Bond-O" and gives instructions for using it and methods for testing water mains jointed with it. Descriptions and illustrations are included of Heating Furnaces, and Tools for jointing with "Bond-O" provided by Northrop & Co.

A Bureau of Community Facilities, Federal Works Agency, Washington, D. C.

A Bureau of Community Facilities has been set up within the Federal Works Agency, effective January 1, 1945, Major General Philip B. Fleming, Federal Works Administrator, announced today.

The Bureau, which will carry out the programs of war public works and war public services under the Lanham Act, which heretofore have been handled by separate divisions, will be headed by George H. Field, of Evanston, Ill., Assistant to the Administrator. He has been appointed Commissioner of the Bureau.

Before becoming Assistant to the Administrator, Mr. Field was FWA Regional Director for Illinois, Indiana, Ohio, Michigan, Wisconsin and Kentucky. A civil engineer and a graduate of the University of Wisconsin, Mr. Field has been in Government service since 1933; prior to that time he was engaged in private construction works.

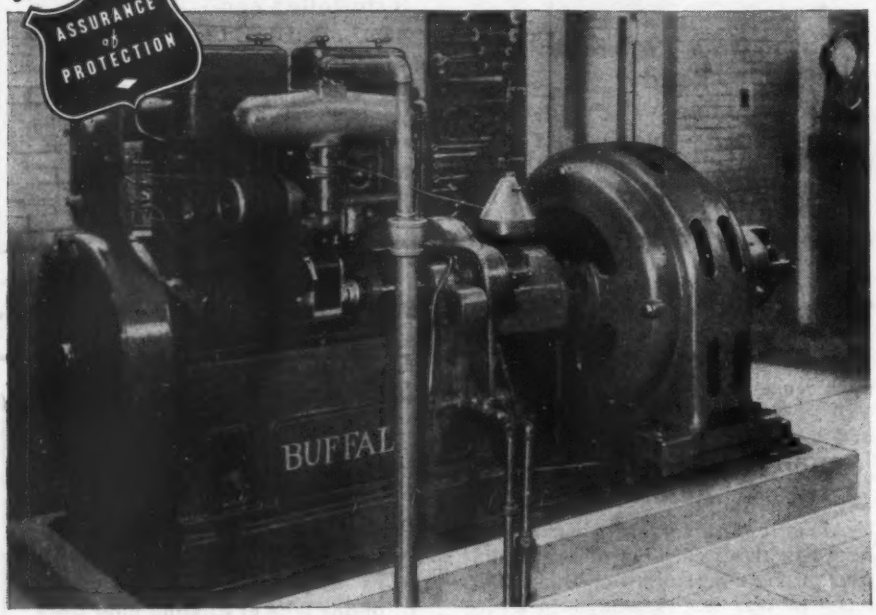
Permutit Elects New Officers

The Permutit Company of New York, manufacturers of water conditioning equipment, has announced the election of W. Spencer Robertson as Chairman of its Board of Directors and Henry W. Foulds as President. Mr. Robertson has been President of the company for the past 15 years while Mr. Foulds has been

(Continued on page 70)

BUFFALO ENGINES — ASSURANCE of PROTECTION

BUFFALO Model RA-4 Engine. Direct-connected to a 75 Kva Generator. Sewage Treatment Plant, Norristown, Penna.



WITHOUT STAND-BY EQUIPMENT POWER FAILURE...*Breeds Disaster!*

Rapidly as repairs to power lines and equipment can normally be made, there is always time for disaster to strike during a breakdown. Fire underwriters, who know more about this than anyone, base their rates upon it as a fact; hence in any community, stand-by equipment pays for itself in insurance savings.

For assurance of protection, select BUFFALO Engines for motor generator or pumping sets. Their specifications will convince the engineer that they are completely trustworthy, and a visit to a Buffalo-powered station will prove to the operating man that here is the ideally clean, quiet-running and dependable motor for this service.

Write for motor descriptions and Specification Sheets for your files.

BUFFALO GASOLENE MOTOR COMPANY
DEPT. PW-15 BUFFALO 13, N. Y., U. S. A.

BUFFALO ENGINES — ASSURANCE of PROTECTION

BUFFALO ENGINES — 100 H. P. THROUGH 750 H. P.— IN GENERATOR AND PUMPING SETS FOR WATER WORKS — AIRPORTS — COMMUNICATIONS — FLOOD CONTROL — HOSPITALS — INSTITUTIONS — MINES — MOVABLE BRIDGES — THEATRES — SEWAGE PLANTS.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

433. "The Selection of Main Line Meters," a highly informative and useful presentation prepared by a competent engineer, J. C. Thoresen, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Meters, Water

435. "Watchdog" water meters, made in standard capacities from 20 GPM up; frost-proof or split case in household sizes. All parts interchangeable with present models of same manufacturer. For bulletins, write Worthington-Gamon Meter Co., 282-296 South St., Newark, N. J.

Piling, Steel Sheet

436. Corrugated Steel Sheet piling of minimum weight, maximum strength, ease of handling is described and illustrated in a 14 page booklet. If you have a job involving piling write Caine Steel Co., 1820 N. Central Ave., Chicago, Ill., for this booklet.

Pipe, Cast Iron

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia 5, Pa.

Pipe, Transite

442. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

Pipe Joints, Sewer

444. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

445. Asphaltic Sewer Jointing materials are described and instructions for using them are included in a folder. Premoulded Sewer Pipe Belt, a modern method of jointing, a faster installation on the job, and Tufflex, a cold trowelling plastic for Sewer Pipe joints are the products. Write Servicised Products Corp., 6051 W. 65 St., Chicago 38, Ill.

Pipe Joint Compounds

446. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

447. Carter Sludge Pumps are described in 8-page illustrated bulletin, including specifications and tables. Address: Ralph B. Carter Co., Hackensack, N. J.

448. Non-clogging, vertical or horizontal, dry pit or submerged; storm water and drainage pumps are described in several Bulletins; also sump and bilge pumps. Dayton-Dowd Co., Quincy, Ill.

Pumps and Well Water Systems

449. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

450. Peerless pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth are described and illustrated in new literature that clearly shows their construction and special features. Write Peerless Pump Div., Food Machinery Corp., 301 W. Ave. at 26th St., Los Angeles 31, Calif.

451. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

452. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Dayton-Dowd Co., Quincy, Ill.

Meter Setting and Testing

454. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Screens

456. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

458. "Disposal of Community Refuse by Incineration" is a handsome 34-page booklet that discusses incineration from a commonsense standpoint. Illustrated by numerous photos of typical installations and includes diagrammatic outlines of various plant designs. Write Morse Boulger Destructor Co., 207-P East 42nd St., New York 17, N. Y.

459. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

460. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York 5, N. Y.

Softening

462. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

Sprinkling Filters

466. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Stand-by Motors

467. Buffalo stand-by motors for generators or pumping units are covered in illustrated specification sheets sent promptly by Buffalo Gasolene Motor Co., Dept. PW, Buffalo 3, N. Y.

Swimming Pools

468. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

470. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York 17, N. Y.

471. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

475. Three types of clarifiers for sewage treatment are illustrated and described in a new bulletin issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill.

476. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

477. All-steel Rotary Distributors, correctly designed for the small and medium sized sewage plants, are the subject of a new, well illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill. This booklet also covers distributors for various types of high-rate trickling filters.

478. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

479. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

480. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadephia 40, Pa.

483. A combination mechanical clarifier and mechanical digester. The Dorr Clarigester is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

484. Preflocculation with chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

485. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

486. 28-page catalog describes and illustrates the Dorrco Hydro-Treator, a self-contained water treatment unit combining Flocculation, Sludge Thickening and Clarification. Reduces treatment time and lowers plant construction costs. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

488. "Packaged" Sewage Treatment Plants, specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

489. "Carter Controlled Flocculation" is title of illustrated folder available on request from Ralph B. Carter Co., Hackensack, N. J.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

493. Full details about Armcre Filter Bottom Blocks for Trickling filter floors, includes drawings illustrating construction details. Complete bulletin available from The Bowerston Shale Co., Bowerston, Ohio.

Valves (See Gates, Air Release, etc.)

Water Treatment

495. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

496. "Use of copper sulphate in water treatment plants" titles informative booklet, with valuable data on chemicals, dosage, etc. Write Tennessee Corporation, Atlanta 1, Ga.

497. Ferri-floc Ferric Sulphate—a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

Water Service Devices

500. Data on anti-freze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

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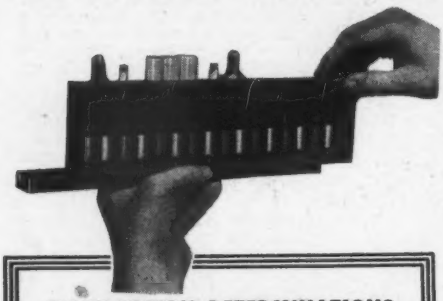

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(Continued from page 66)

Executive Vice-President since 1935. Prior to that time he had been a Vice-President and Director of Goulds Pumps, Inc., and a Vice-President of Servel, Inc.

Both officers assume their new duties at a time when the company is about to resume production of household water softeners. In the municipal and industrial field, Permutit produces a variety of types of equipment. Among them are hot lime soda softeners, Spaulding Precipitators, Spiractors and zeolite softeners. Other water conditioning equipment such as filters, iron, oil, color, taste and odor removal systems, coagulation equipment and power plant specialties including continuous blowoff systems, combustion recorders, degasifiers and deaerators, are also produced and marketed by the company.

The A. P. Smith Mfg. Co. Appoints Gerald J. Manahan General Sales Manager

The A. P. Smith Manufacturing Company announces the resignation of Mr. Thomas L. Halpin as General Sales Manager, effective January 1, 1945.

Mr. Halpin, who has been with the company for twenty years in a sales capacity and as General Sales Manager since January 1, 1942, is resigning because of a progressive eye ailment which has made it impossible for him to continue in this capacity. He will remain in the sales organization of the company, returning to his former sales territory.

Mr. Gerald J. Manahan will succeed Mr. Halpin as General Sales Manager. Mr. Manahan has represented the company in the New England territory for a number of years and is well known to the members of the water works profession. Previous to his affiliation with the A. P. Smith Manufacturing Company in the New England territory, Mr. Manahan served several years in a municipal water department and was subsequently General Manager of a water works equipment and supply company.

Mr. Frank F. Wells will succeed Mr. Manahan as Sales Engineer for the New England territory.

The new New England sales office of the company will be located at 54 Elm Street, Melrose, Mass., under the direction of Mr. Wells.

Samuel I. Zack Joins Gannett Fleming Corddry & Carpenter, Inc.

Mr. Zack is a specialist in Sanitary Engineering on Sewage and Water Purification. He is a graduate of Massachusetts Institute of Technology and spent ten years with the Sanitary District of Chicago in the sewage experimental station, and on the design of sewage treatment works.

Later he was with Fraser Brace Engineering Company on water, sewage and industrial waste treatment plants and more recently with Stone & Webster Engineering Corporation.

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